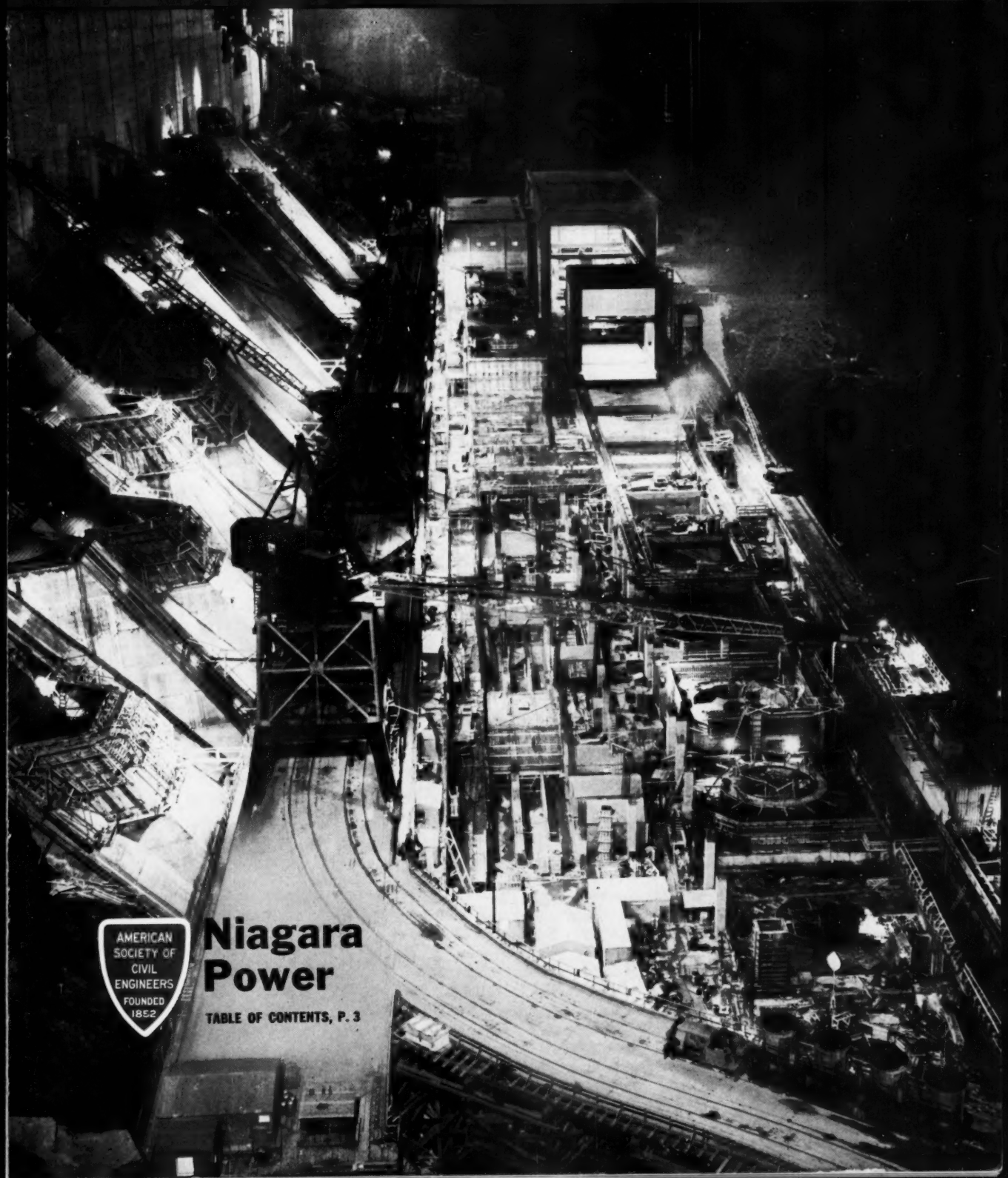
CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION • APRIL 1961



AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

Niagara Power

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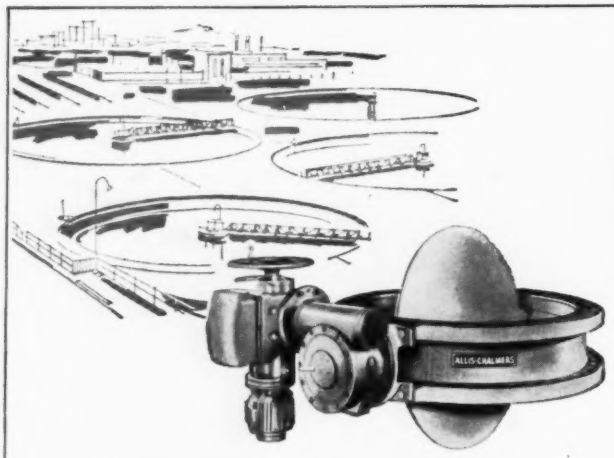
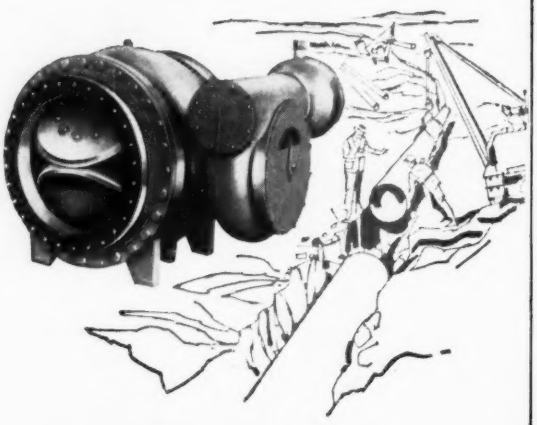
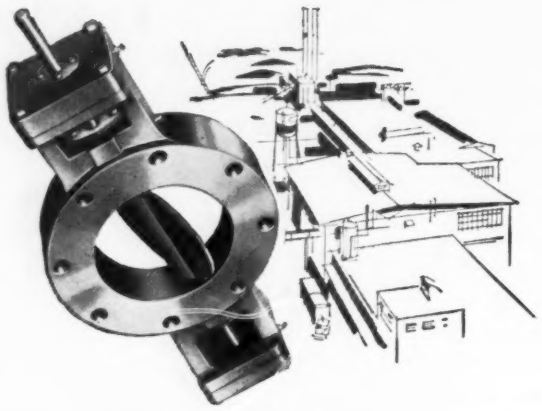
ALLIS-CHALMERS



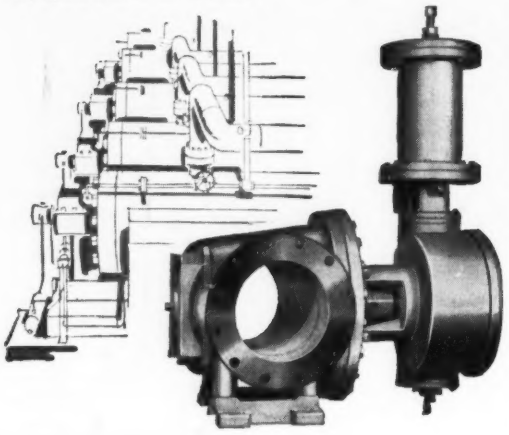
BUTTERFLY VALVES — For liquids or gases — uniform control in all positions, fast positive regulation and closure, minimum pressure drop. Compact and lightweight. Sizes from 1 in.



BALL VALVES — Easy manual shutoff under adverse conditions, and up to 150 psi. Slight wedging action gives unusually drop-tight closure. Sizes: 12 to 48 in.



WAFER VALVES — A new design of butterfly valves with space-saving flexibility, suited to most any type of operation. Sizes from 3 to 36 in., including high-pressure types.



ROTOVALVE — A cone valve suited to virtually any type of operation or location. Offers the least pressure loss, greatest initial shutoff, controlled closing time, positive seating.

Now: for power plants, sewage and water works —

a full line of rotary valves

Serving you even better through a broader line—Allis-Chalmers offers the finest in butterfly, ball and cone valves for industrial applications, power plants, sewage and water works. Also available are complete valving systems in standardized "packages" that provide *remote, telemetered control of valve operation.* These additions further round out Allis-Chalmers line that includes Angle, Needle, Relief valves, sleeve-type valves and accumulator systems. *For details, contact your Allis-Chalmers valve representative or write* **Allis-Chalmers,** *Milwaukee 1, Wisconsin.* Rotovalve is an Allis-Chalmers trademark.

A-1381

WATER HAMMER: *the chief cause of water main breaks*

(but it's no problem when you use large-diameter **steel** pipe)

Don't take a chance on breaks due to water hammer. Use pipe that can "take it." Use tar-enameled steel pipe for all large-diameter mains.

Of all water pipe materials only steel gives you absolute assurance against failure due to water hammer and surge. Just check this table—Theoretical Internal Pressures of Steel Pipe:

	1/4 in.			5/16 in.			3/8 in.			7/16 in.			1/2 in.		
TYPICAL ID	WT LB/FT	MAX WRK PRESS PSI	MIN BURST PRESS PSI	WT LB/FT	MAX WRK PRESS PSI	MIN BURST PRESS PSI	WT LB/FT	MAX WRK PRESS PSI	MIN BURST PRESS PSI	WT LB/FT	MAX WRK PRESS PSI	MIN BURST PRESS PSI	WT LB/FT	MAX WRK PRESS PSI	MIN BURST PRESS PSI
24	69	335	1040	86	420	1300	102	505	1560	119	585	1820	136	665	2080
30	86	270	835	108	340	1040	129	405	1250	150	475	1455	170	535	1670
36	106	225	695	130	280	870	155	340	1040	181	395	1210	206	445	1390
42	119	195	595	148	240	745	177	285	890	206	335	1040	234	380	1190
48	137	170	520	171	210	650	203	250	780	236	290	910	268	330	1040
60				214	170	525	255	200	625	296	235	730	336	265	835
72	NOTE: Higher strength steels are available which permit the use of higher working pressures.						309	170	520	359	195	605	408	220	695
96										470	145	455	539	165	520

NOTE:
Based on use of ASTM A-283, Grade B Steel, 50,000 psi min. ultimate tensile strength.

$P = \frac{t \times Ts}{r}$

P = internal pressure, psi
t = thickness, in.
Ts = allowable unit stress = 60% x 27,000 (yield point) = 16,000 psi
r = radius of pipe, in.

And remember—every length of large-diameter steel pipe is hydrostatically tested in the shop in accordance with A.W.W.A. standards, usually to twice the working pressure. No other pipe available in such large diameters is subjected to this test. For more information about tar-enameled steel pipe, contact the Bethlehem sales office nearest you.

Steel *for Strength*
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, Bethlehem, Pa.
Export Sales: Bethlehem Steel Export Corporation

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CIVIL ENGINEERING

APRIL 1961

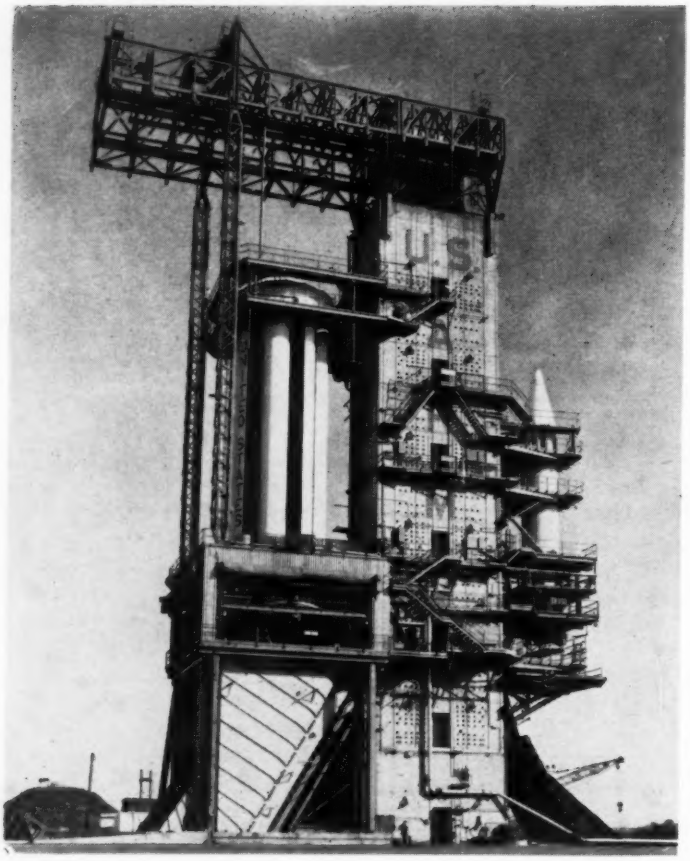
VOL. 31 • NO. 4

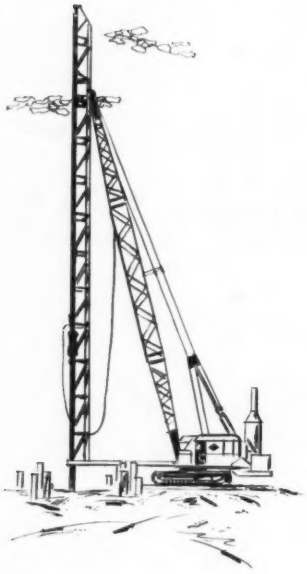
THE MAGAZINE OF ENGINEERED CONSTRUCTION

• *ARTICLES*

• *ASCE NEWS*

• *DEPARTMENTS*





Built to withstand the thrust of our biggest missiles!

AND RESTING ON PILES DRIVEN BY C. L. GUILD

THIS is a picture of the main captive test stand at the NASA Marshall Space Flight Center, Huntsville, Alabama. And it is another example of the versatility of C. L. Guild Construction Co., Inc.

C. L. Guild drove the foundation piling immediately adjacent to and to the left of the tall square concrete structure. This new missile firing apparatus is capable of supporting our largest missiles. C. L. Guild, working for the J. A. Jones Construction Company of Atlanta, Georgia, drove: 3,000 lineal feet of 14 inch "H" piles; 2,500 lineal feet of 12 inch "H" piles; and 3,000 lineal feet of steel sheet piling.

Guild operates on a nation-wide basis. And Guild engineers, trained by experience on hundreds of the biggest construction jobs in the country, will gladly confer with you on your pile driving problems. Their experience can help you.

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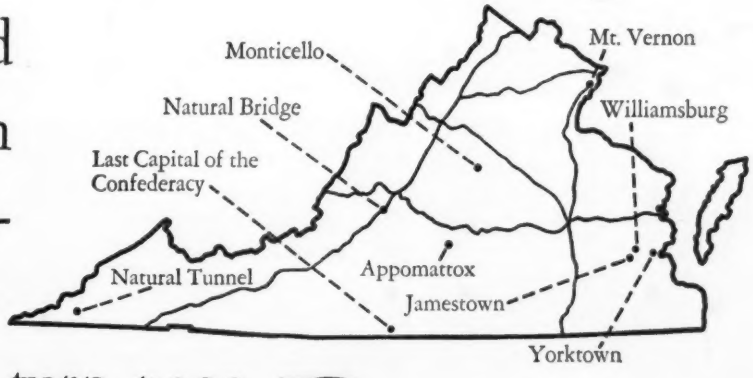
BOSTON, MASS. WASHINGTON, D. C. HOUSTON, TEXAS
SYRACUSE, NEW YORK ATLANTA, GEORGIA KANSAS CITY, MO.

In the 1780's it took Thomas Jefferson's coach-and-four about five days to travel the 100 miles from Richmond to Alexandria, Va. Today it takes about two hours. The difference is modern horse-power and 100 miles of four lane highway.

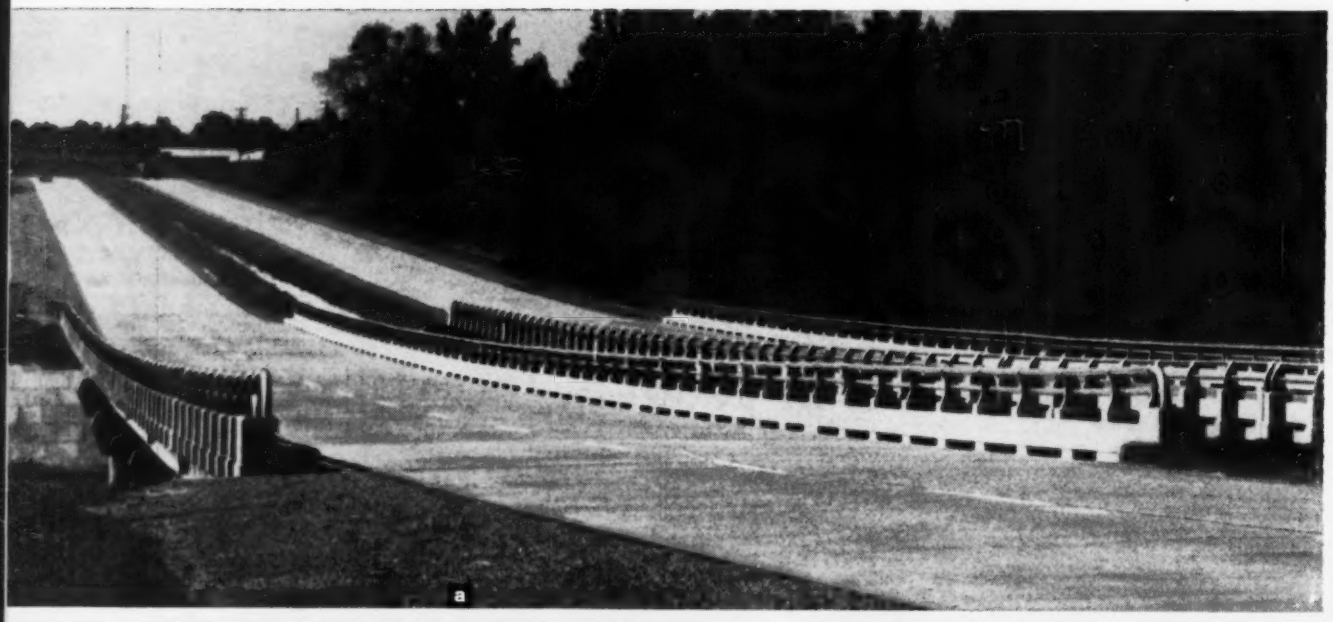
In 1961, more than 1,000,000 tourists will visit some of the Nation's oldest landmarks in Virginia. And they'll travel on some of the Nation's newest highways because Virginia is spending about $76,000,000 in Federal aid funds on its Interstate Highway program. This, in addition to two bond issue projects: the Richmond-Petersburg Turnpike and the Hampton Roads Bridge-Tunnel. For more details, turn page.



Steel Products are the backbone of Virginia's Interstate Highways

Virginia has more than 25,000 miles of hard surfaced roads right now and they're building more. Proposed for construction are 1,053 miles of four lane, controlled access Interstate Highways. This is Virginia's part of the Nation's 41,000 mile Interstate Highway Program. In Virginia, over 80 miles of the Interstate system are in use and 250 of the proposed 2,263 bridges have been built. This work is under the direction of State Highway Commissioner Howard H. Harris and Francis A. Davis, Chief Engineer and Deputy Commissioner.

Millions of feet of steel reinforcing bars criss-cross through the concrete to lock strength into the roadway. Each bridge is designed to take advantage of the strength and economy of steel. USS High Strength and carbon structural steels are effectively combined for minimum bridge weight and maximum clearance. USS "T-1" Constructional Alloy Steel and USS MAN-TEN, TRI-TEN and COR-TEN High Strength Steels are used in bridges where more load capacity, less dead weight and higher corrosion resistance is needed. USS Galvanized Culvert Sheets carry thousands of streams harmlessly under embankments. USS AMERICAN Fencing protects right-of-way and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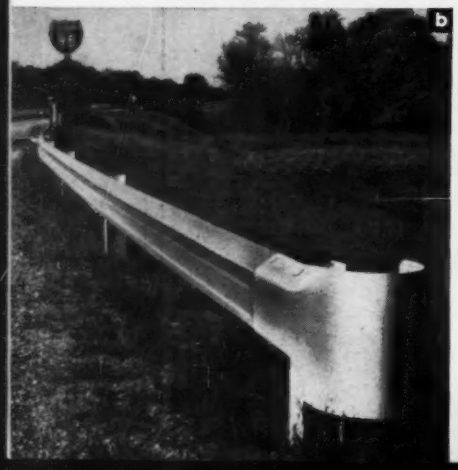
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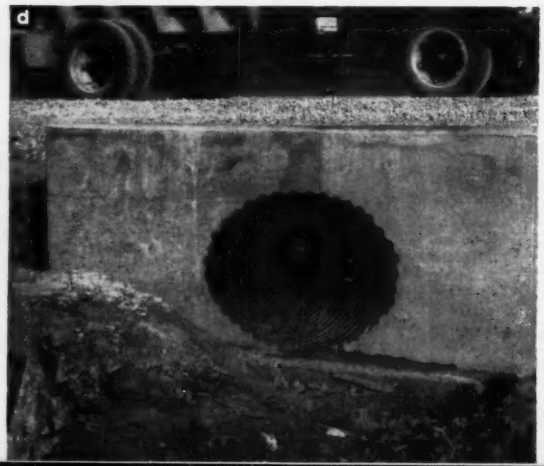
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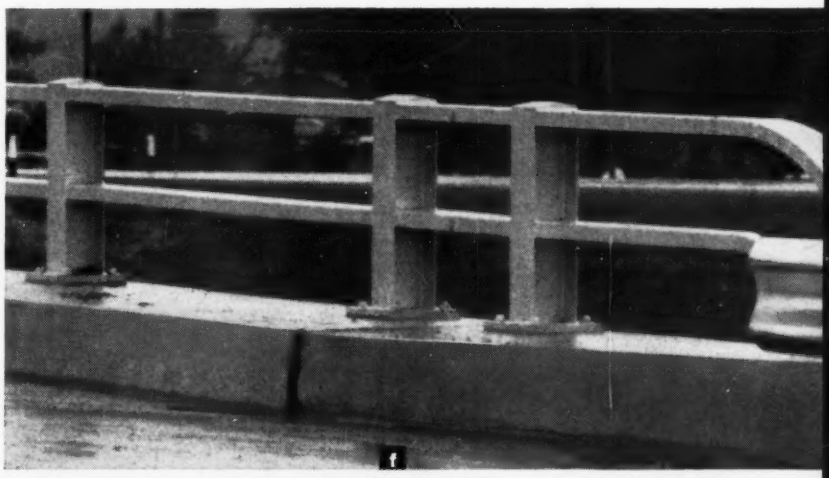
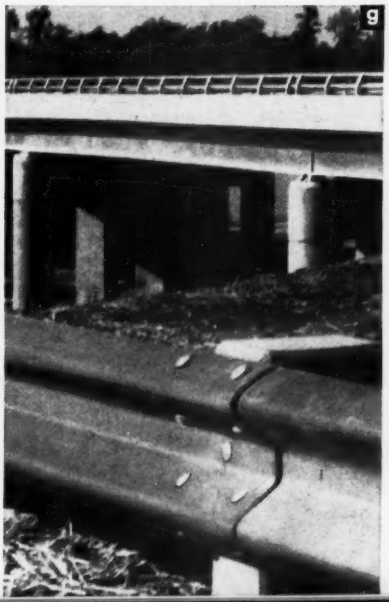
USS Highway Beam Guardrail provides safety protection at critical points along the roadway. Steel is also used for driving aids, markers and lighting standards. The *strength* of the Virginia Interstate Highway Program is *steel.*

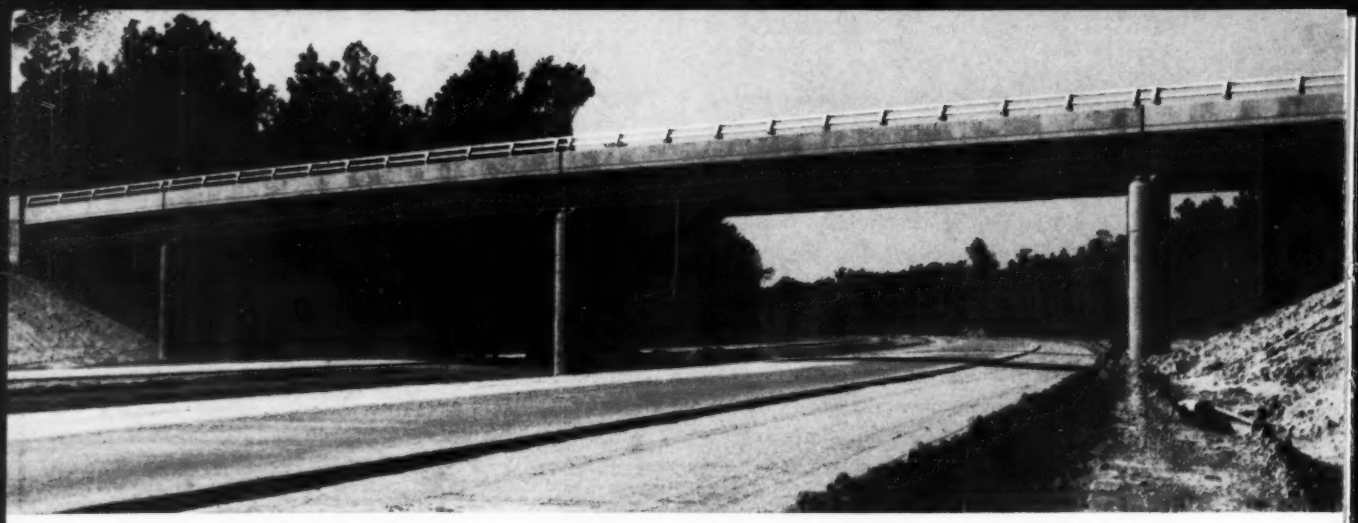
a The design of each bridge is based on the strength of steel. Bridge railings, reinforcing bars and structural members are all made from steel. **b** Highway guard rail. USS AMERICAN Highway Beam Guardrail has been accepted by most state highway departments because of its extra strength, high visibility and attractive styling. **c** Giant steel auger drills through toughest terrain in all seasons. USS High Strength Steels have the toughness and impact resistance it takes for heavy construction equipment. Steel is so versatile it is used in all types of construction equipment for lightweight and heavy duty applications. **d** Road embankments are saved from costly erosion with steel culverts fabricated from corrugated galvanized USS Culvert Sheets. Culvert sheets assemble easily and first cost is low. They make an ideal economical and strong waterway channel. **e** Steel H-piles are driven to provide solid foundations for bridge piers and abutments. Cranes equipped with USS TIGER BRAND Wire Rope handle more work with less down time. USS TIGER BRAND—America's No. 1 Wire Rope always gives top performance under the most severe conditions. **f** Bridge railings, reinforcing bars and structural members are all made from steel. **g** Steel gives strength to bridges and provides safety protection when it's formed into guardrails. **h** Strong roadways are made with reinforced concrete. USS AMERICAN Welded Wire Fabric has a minimum tensile strength of 75,000 psi and a minimum yield point of 60,000 psi, available in a wide range of styles and sizes. USS DI-LOK Concrete reinforcing bars for pavements, bridge floor slabs, footings and abutments are supplied bent to specification. Highways are built faster and more economically with USS pre-engineered products.

USS, DI-LOK, TIGER BRAND, AMERICAN, COR-TEN, TRI-TEN, MAN-TEN and "T-1" are registered trademarks.

USS United States Steel







Steel bars reinforce pavement for maximum load-carrying capacity and long life. Steel lighting standards and other highway accessories are made from steel. They look attractive with a minimum amount of maintenance and last a long time.

Send for U. S. Steel's *free* 54-page booklet, "Keep Our Roads on the Go." It tells how the complete range of highway products and services available from U. S. Steel cut costs and speed operations in every phase of highway construction.

This mark tells you a product is made of modern, dependable Steel.

USS United States Steel

TRADEMARK

The highway market also is served by the following divisions of United States Steel: American Bridge Division, Pittsburgh, Pa. • American Steel & Wire Division, Cleveland, Ohio • Columbia-Geneva Steel Division, San Francisco, Calif. • Consolidated Western Steel Division, Los Angeles, Calif. • National Tube Division, Pittsburgh, Pa. • Tennessee Coal & Iron Division, Fairfield, Alabama • Universal Atlas Cement Division, New York • United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.

United States Steel
Room 6279, 525 William Penn Place
Pittsburgh 30, Pennsylvania

Please send me your booklet, "Keep Our Roads on the Go."

Name_____

Company_____ Title_____

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HERE'S HOW TO MOVE 18 MILLION GALLONS OF WATER EVERY DAY

In virtually constant use, Peerless pumps insure dependable water flow to utility's 18,000 customers . . .

The Dominguez Water Corporation has a colorful history that dates back to the early Spanish land grants in California. It was first formed in 1911 and its initial patrons were farmers of land which formed a part of the historically famous Rancho San Pedro.

Today this privately owned public utility serves over 17,000 residences and 1,000 agricultural and industrial customers. Its service area comprises a 35 square mile section in the southern part of Los Angeles County.

Throughout the system, this immaculate-looking facility makes virtually constant use of Peerless pumps. Practically all of the water they distribute is pumped by Peerless. From tiny 2 hp Fluidyne pumps and large Type A booster units to mammoth deep well turbines, these sturdy pumps keep water moving in a steady flow. Many of the pumps have seen 25 years or more of continuous service. And downtime for repairs is practically nonexistent, reports operation personnel.

Years of performance. Lowest possible maintenance attention. Best service. These are typical qualities you can expect and get in a Peerless pump. Get the facts on this fine complete line of pumps now. Write today for a catalog and the name of the Peerless representative in your area.

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Putting Ideas to Work

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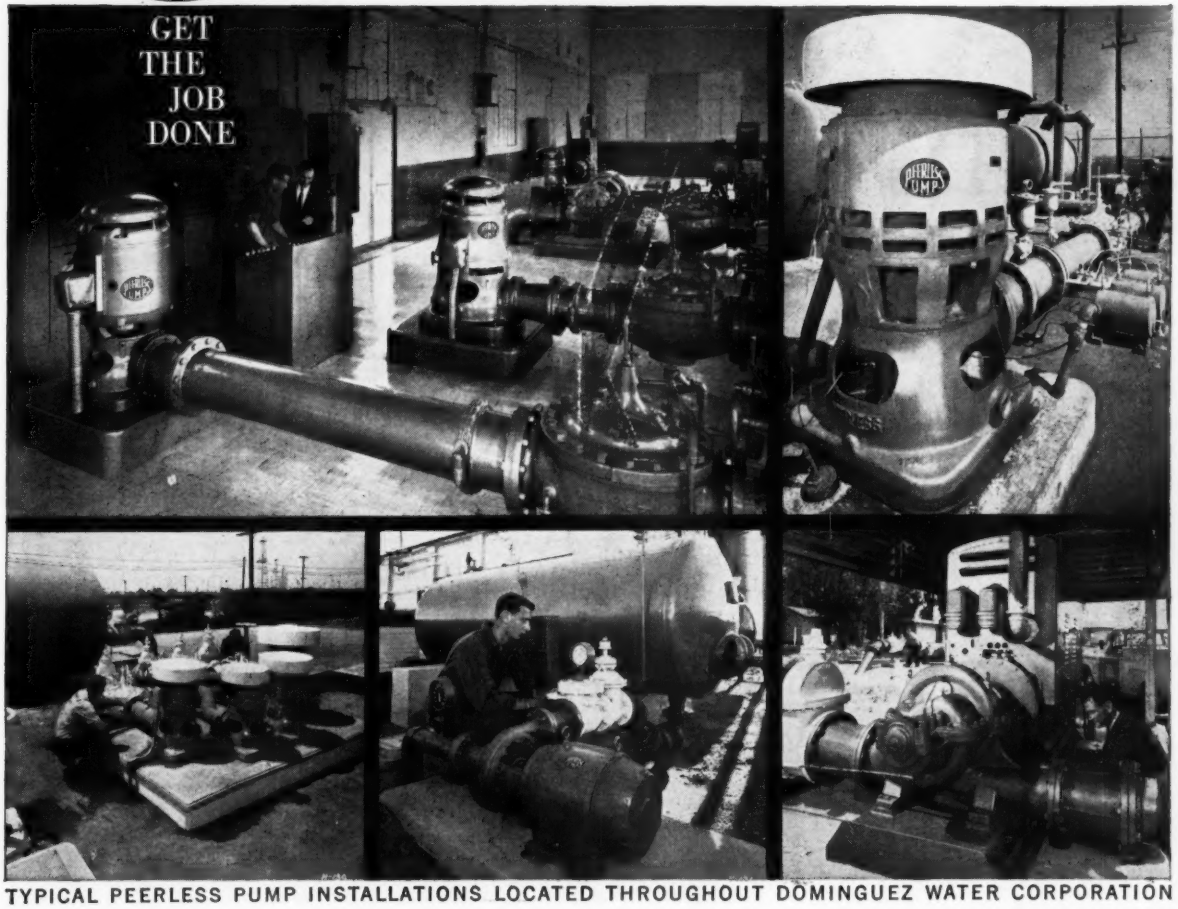
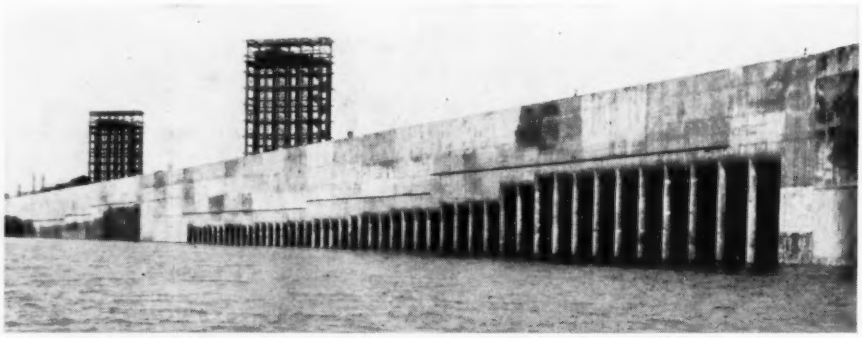
Offices: New York; Detroit; Chicago; Cleveland; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

Distributors in principal cities. Consult your telephone directory.



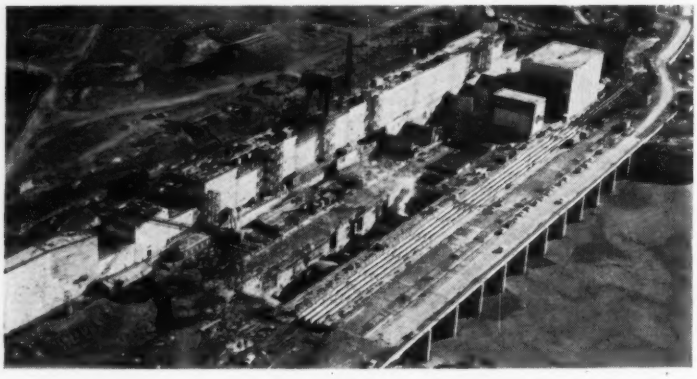
TYPICAL PEERLESS PUMP INSTALLATIONS LOCATED THROUGHOUT DOMINGUEZ WATER CORPORATION

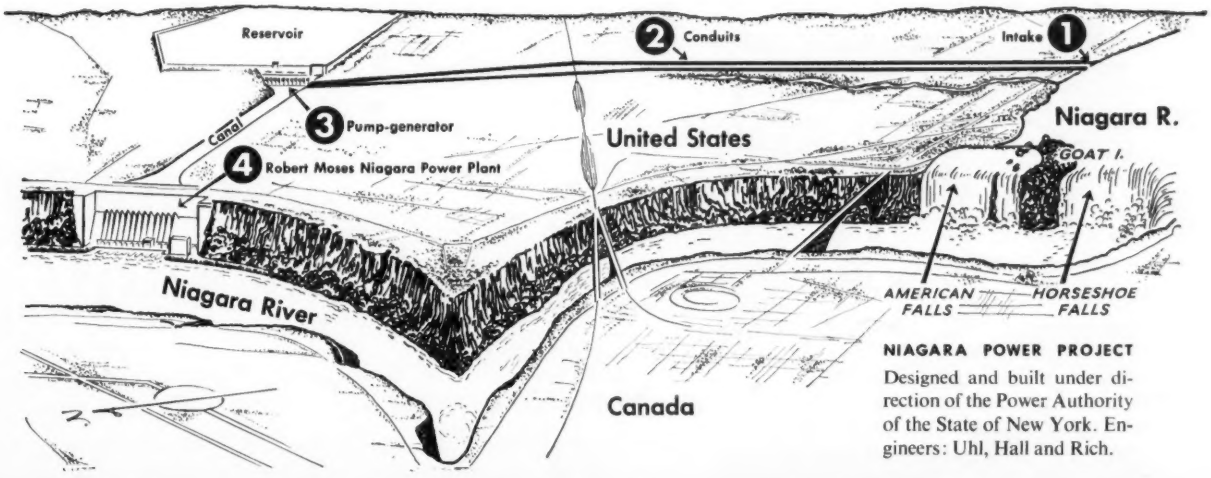
1 The "harmonica" intakes are two reinforced concrete sections, each 700′ long, located 2½ miles above Niagara Falls. Each section admits water to its own concrete conduit. In operation, tops of the intake slots vary from 13′ to 26′ below the river surface. The gate structures for each conduit are seen above the intakes. **Contractor:** Merritt, Chapman and Scott Corp.



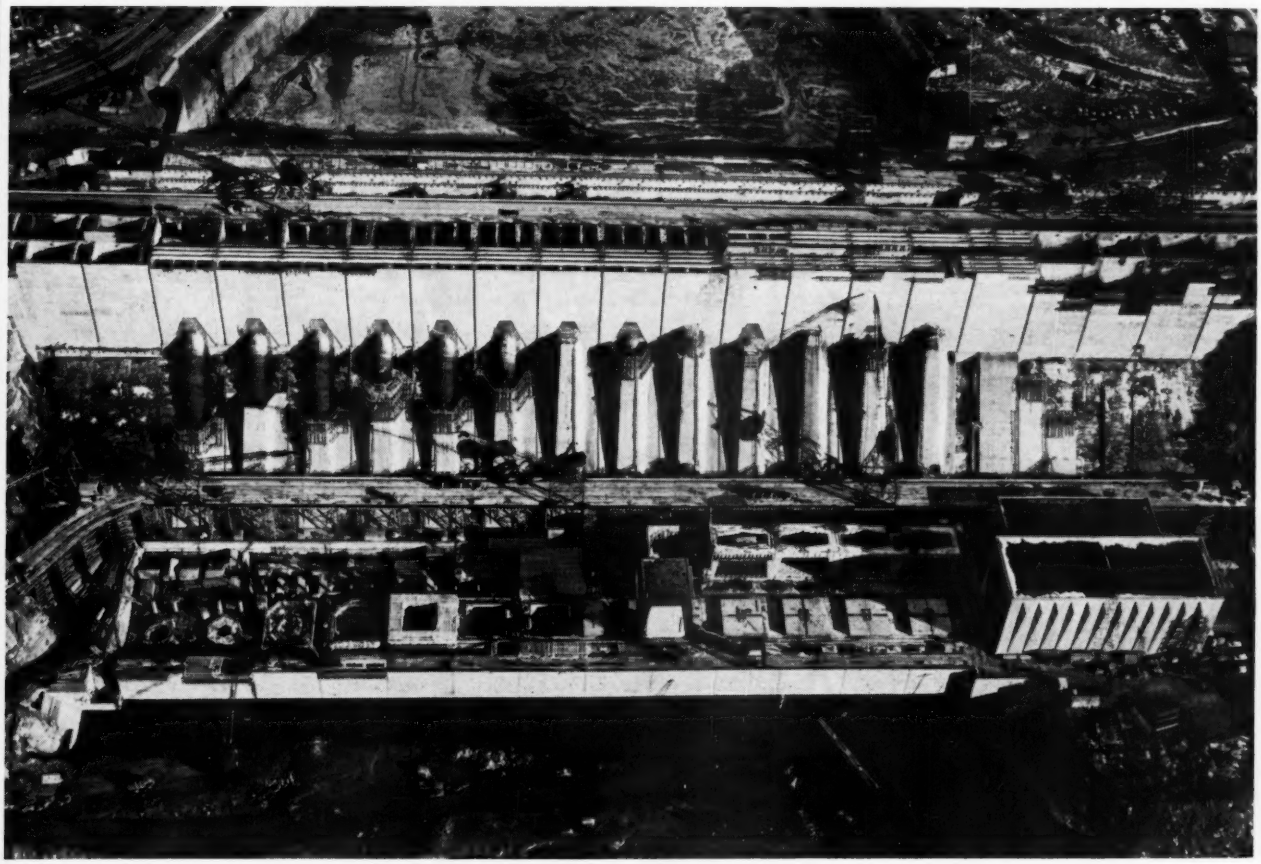
2 A section of one of the two concrete conduits which run from the intakes some 4 miles through the city of Niagara Falls and the towns of Niagara and Lewiston. Walls and floors of conduit are a minimum of 2½′ thick, and the haunch section is about 7′ thick. The arch is 5′ thick at the top and 6′ at the base. The inside of each conduit measures 46′ wide by 66′ high to the crown of the arch—a size equivalent to six double-track railroad tunnels. Conduits were built in 40′ sections employing traveling concrete forms. Tops of the conduits average more than 40′ below the ground surface. **Contractors:** Merritt, Chapman and Scott Corp.; Edward Balf Co., Savin Brothers and D. W. Winkelman in joint venture; Gull Contracting and L. G. Defelice & Son in joint venture.

3 Water enters open canal from conduits. Pump-Generating plant is 974′ long, 160′ high and 240′ wide. Reversible pump-turbines pump extra water available at night, under U. S.-Canadian treaty, into a storage reservoir. During daylight hours water is released through these reversible units to provide 240,000 kw. Water then continues to main generating plant to be reused for more power. The lower deck of the plant is extended over draft tube outlets to serve as a bridge to carry the permanently relocated Military Road and the new Niagara Expressway. **Contractors:** Tuscarora Contractors, Arundel Corp., L. E. Dixon Co., and Hunkin-Conkey Construction Co. in joint venture.





NIAGARA POWER PROJECT
Designed and built under direction of the Power Authority of the State of New York. Engineers: Uhl, Hall and Rich.



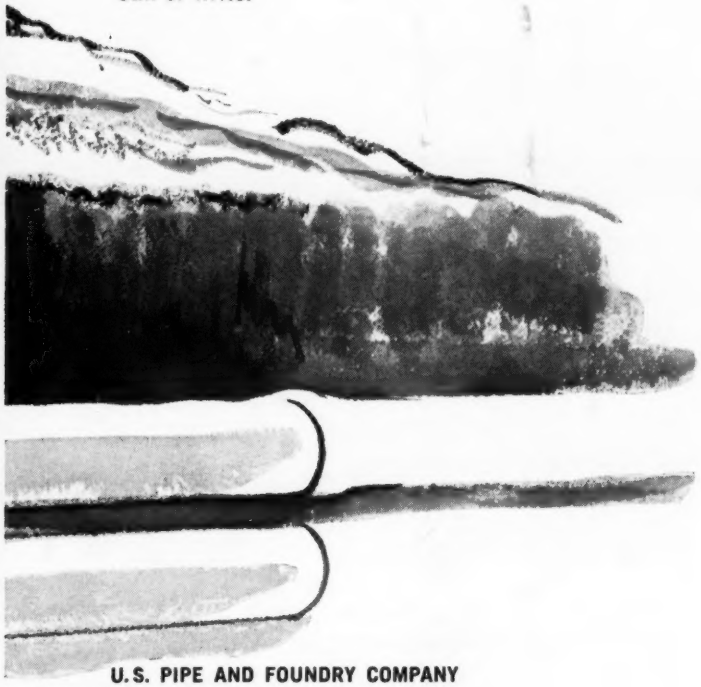
4 The Robert Moses Niagara Power Plant seen here, in combination with the reservoir plant, forms the western world's biggest power project. The reinforced concrete structure is approximately 1,840′ long—the length of five football fields. It is 389′ high, 580′ wide. The 13 penstocks (the first generator began operating February 10) are concrete encased and concrete anchored. Two four-lane concrete highways will pass over the downstream face of the intake structure. Some of the 599 prestressed concrete beams to carry these roadways can be seen in the photo. **Contractor:** Merritt, Chapman and Scott Corp.

worth looking into!

Fact! Whenever . . . wherever Tyton Joint® pipe goes into the ground it wins more than its share of attention.

And why not? Tyton's so simple . . . so easy to assemble . . . it's a joy to watch. Only one accessory needed—a rubber gasket. No bell holes. No nuts, bolts or caulking equipment. Reduces weather worries too . . . Tyton can be laid in rain or wet trench.

Simple, speedy, sure, Tyton Joint* pipe is one big answer to today's problem of steadily rising costs. Get the money, time and labor-saving facts today. Call or write.



U.S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A Wholly Integrated Producer from Mines and Blast Furnaces to Finished Pipe.

*U.S. Patent No. 2,953,398

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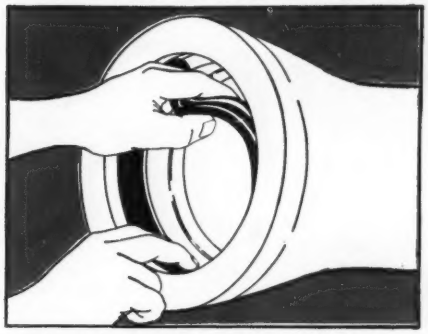
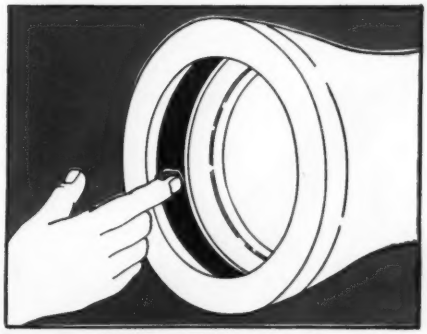
TYTON®

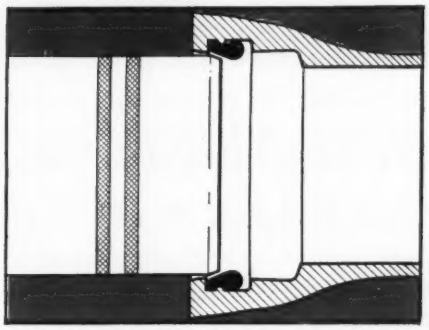
ONLY FOUR SIMPLE ACTIONS



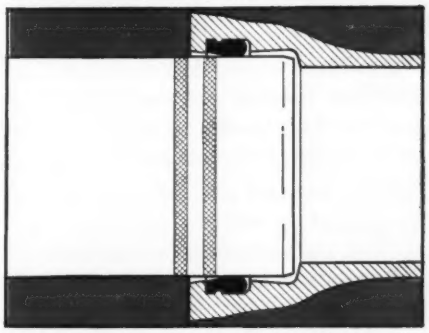
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



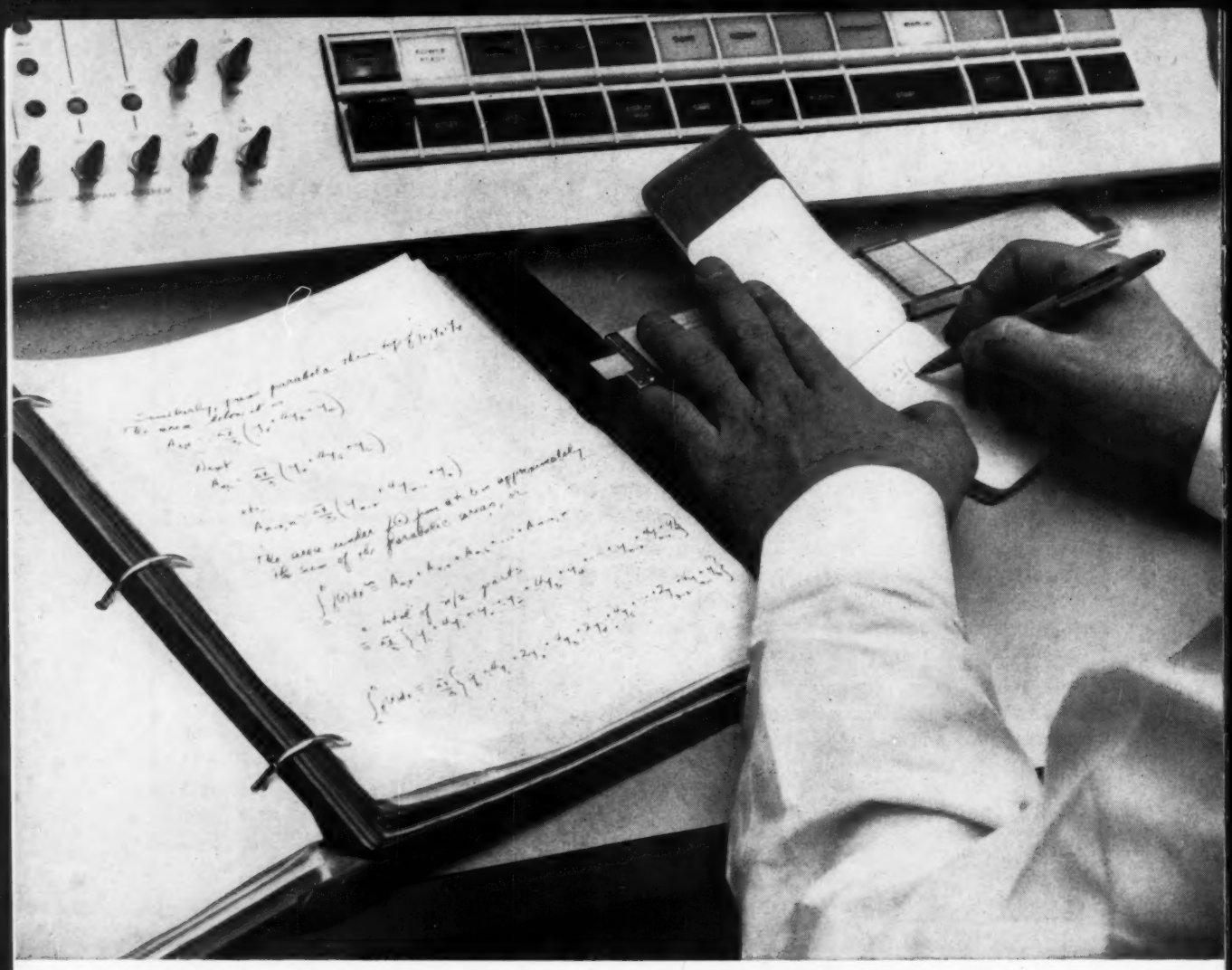
Wipe film of Tyton Joint® lubricant over inside of gasket. Your receiving pipe is ready.



Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.



Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . . fast, efficiently, economically. Could anything be simpler?



Free engineers for creative assignments with the new low-cost IBM 1620

The IBM 1620 Data Processing System is a low-cost solution to the problem of freeing engineers for their most creative and profitable assignments. Here's why:

EASY TO USE—Just a two-day training class is all you need to put your 1620 into operation. This means no delays in learning to use the 1620 computer.

In addition, you get a wide range of free programming services including FORTRAN and GOTRAN. FORTRAN is the powerful scientific language that lets you solve problems without writing detailed computer instructions. GOTRAN is a simplified language (a sub-set of FORTRAN) that lets you enter simplified problem statements and data into the computer with the solution immediately available, in one simple operation.

FAST—The 1620 solves a set of ten simultaneous equations in only 20 seconds. It inverts a 10 x 10 matrix in just 42 seconds.

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To learn how the 1620 can free you for more creative engineering work, call your local IBM representative.

IBM's 1620 is a compact desk-size computer.

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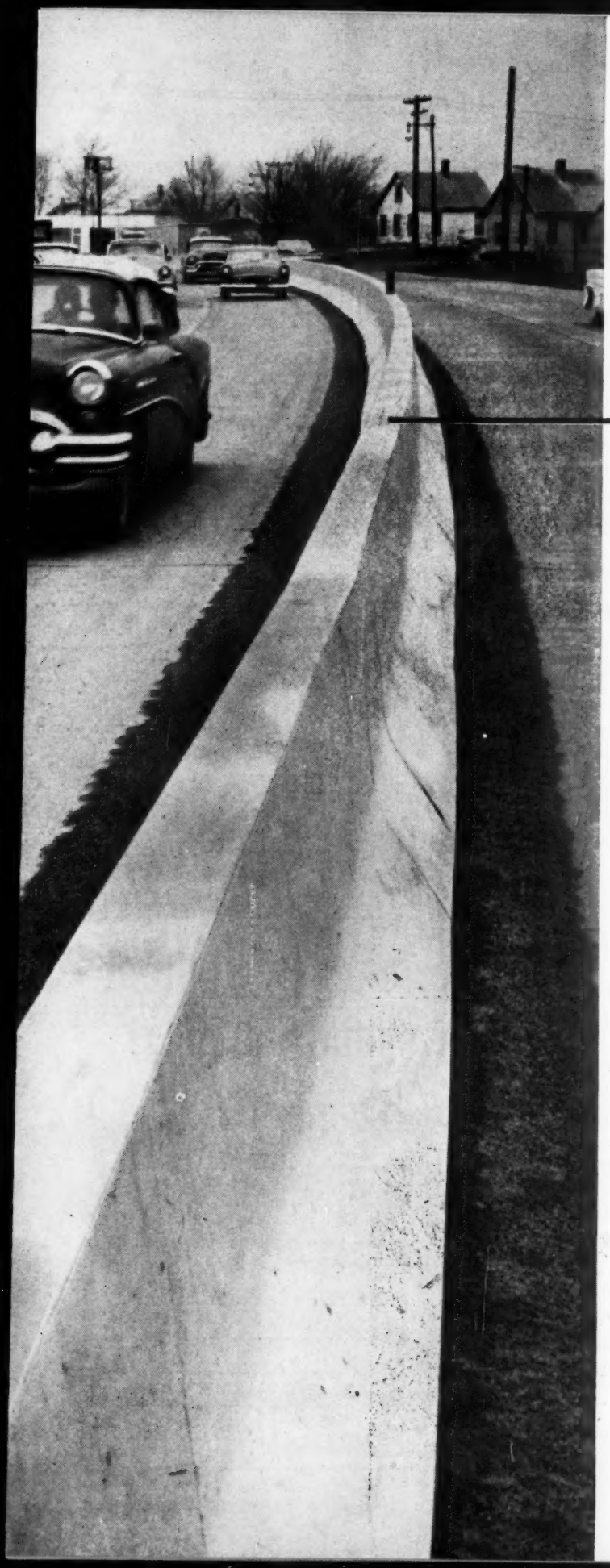
DATA PROCESSING



Unretouched photo of concrete barrier taken last spring following a severe winter.

White concrete center barriers: new safety for existing roads

This concrete center barrier on Route U.S. 46, New Jersey, has been successful in preventing head-on collisions on this heavily traveled approach to the George Washington Bridge. Cast in place with ATLAS WHITE portland cement, the barrier is 32 inches high, 24 inches wide at the base, with sloping sides. This design minimizes the possibility of vehicles mounting the barrier and helps shield oncoming headlights. This construction has become an important feature in New Jersey's program to build safety into existing highways where the installation of center islands is impractical.

ATLAS WHITE air-entraining portland cement was specified for the concrete in this installation because its uniform whiteness provided contrast between barrier and the darker pavement. And at night, this contrast is even more apparent. In addition, the air-entraining property of this cement also provides a more durable concrete that resists the destructive effects of freezing-thawing weather and the application of deicing salts. For more information on white portland cement, write Universal Atlas, 100 Park Avenue, New York 17, New York.

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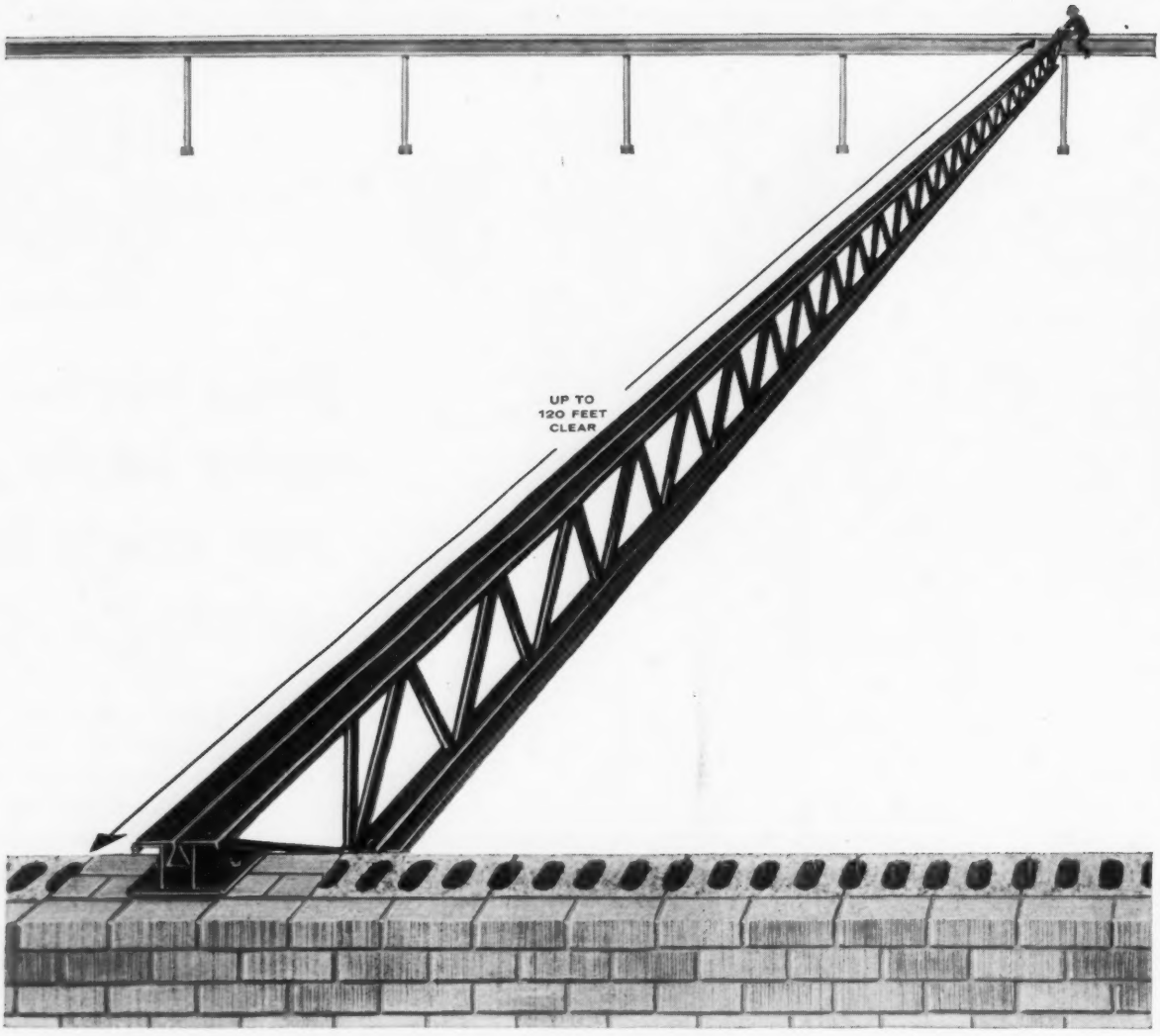
USS



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Galion 160 works hardest where workpower counts most

This husky 160-hp. grader makes full use of more than 30,000 pounds of well-balanced weight to put more "push-power" at the blade — where power counts most in high-output grading.

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Restricted site problem solved with **REINFORCED CONCRETE**

A country club on one side . . . a river on the other . . . restricted the construction site for this interchange bridge in Trinidad, Colorado. To overcome this problem, Ken R. White, Inc., Consulting Engineers, designed for reinforced concrete. A closed abutment frame was used to eliminate the need for approach spans. If you have a design or construction problem, you too may be able to solve it more readily with reinforced concrete. On your next project, investigate this versatile, low-cost, timesaving construction material.

Concrete Reinforcing Steel Institute
38 South Dearborn Street, Chicago 3, Illinois

Interchange Bridge over Interstate Rt. 25, Trinidad, Colorado
Owner: Colorado Department of Highways
Designers: Ken R. White, Consulting Engineers, Denver
Contractor: Dominic Leone, Trinidad, Colorado

3-61

GRIFFIN **Solves Another Dewatering Problem!** Two areas, 500' apart, at the Trenton Sewage Treatment Plant, Trenton, N. J., were dewatered in record time using a GRIFFIN Wellpoint System with a **single** pump station.

One ring of Wellpoints encircled excavations for four 75' diameter digestors. Another ring encircled two 125' diameter clarifiers. The two rings were connected to the single pump station by a common suction line. The strategic location of this double duty set-up dewatered the entire plant site with a minimum of equipment and effort.

Further proof of time and money saving advantages of GRIFFIN Wellpoint engineering, supervision and equipment.

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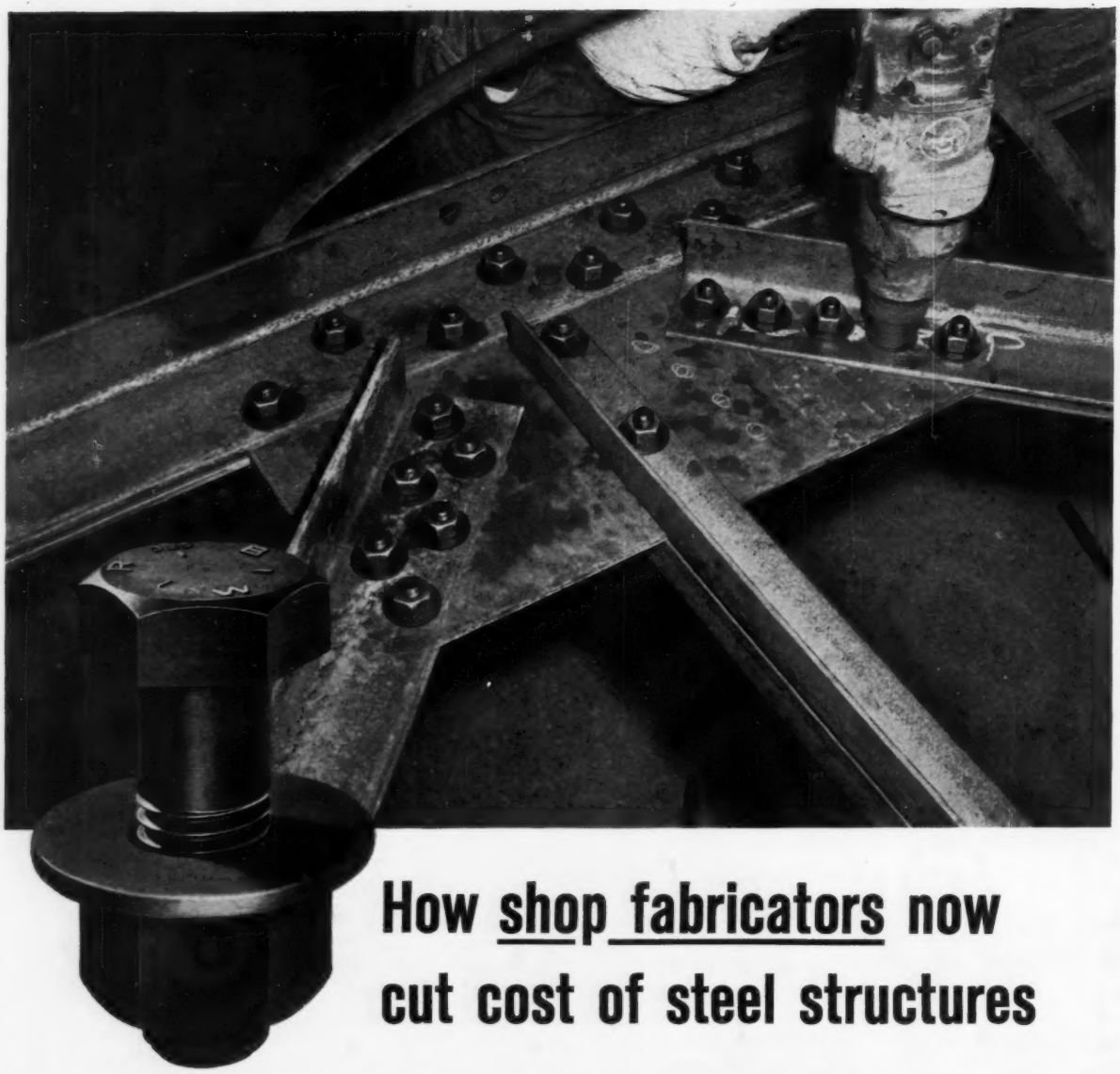


How shop fabricators now cut cost of steel structures

Shop bolting gives more production from existing shop space and facilities. No question about it. An accurate shop time study comparing high strength bolting with riveting proved this conclusively. It also verified savings in finished assembly cost.

Now, RB&W's new large-head, short-thread, A325 structural bolt makes these results all the more valid, the savings even more substantial.

That's because they eliminate one washer out of every two required formerly. And in bearing-type connections, two of these bolts do the work of three regular structural bolts, or three rivets. Many extra operations are avoided in punching, reaming, and filling holes. All told, the savings in bolts, nuts, and washers alone total as high as 40%. Couple this with the more efficient fabrication and movement of assemblies through the shop and you can see why *bolted* steelwork has become competitive with less desirable methods.

With RB&W High Strength A325 Bolts, shop fabricators can be confident of proper quality . . . it's *certified*. Structural engineers, in turn, are assured of full specified shear strength in every joint. Send for data on time study, or for copy of new specification. Write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

RB&W
116th year

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Sales office and warehouse at: San Francisco, Calif. Sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas. Sales agents at: Cleveland; Milwaukee; New Orleans; Denver; Fargo.

LARGEST INDEPENDENT PRODUCER OF HIGH STRENGTH BOLTS FOR CONSTRUCTION

NEWS OF MEMBERS

Warren W. Parks, civil engineer, village manager, civic leader, has been named "Engineer of the Year" by the Technical and Scientific Societies Council of Cincinnati. Mr. Parks has been village manager of Indian Hill, Ohio, since 1943, and has been responsible for establishing all of the fundamental engineering works and policies of the community. He was Director of ASCE from 1953 to 1954.

Nazir Ahmed Khan, since 1952 a construction engineer in the Karnafuli Paper Mills of East Pakistan, was recently named acting chief engineer there. Before his promotion, Mr. Khan planned, designed and executed civil engineering and structural works which substantially expanded mill and living facilities.

Milton S. Sachs, upon his recent retirement as chief hydrologist with the Bonneville Power Administration after 30 years of service with the Federal Government, received the Department of the Interior's Distinguished Service Award. Significant among his contributions have been a method for forecasting more accurate and higher dependable flows, a cooperative Federal hydrologic network program of reporting facilities, and an investigation of the additional needs of the Pacific Northwest area for hydrologic data.

Ivan Metzger, assistant professor of civil engineering at the Newark (N.J.) College of Engineering, has received a $2,000 doctoral fellowship in sanitary engineering, part of a $5,000 bequest given to NCE under the will of Walter S. Baver, M.ASCE, former engineer in charge of the Newark Division of Sewers. Mr. Metzger, who holds a bachelor and master's degree from NCE and a master's from the Massachusetts Institute of Technology, will use the fellowship to continue his studies in sanitary engineering at New York University, where he has completed nearly two year's work.

Ralph H. Wallace, senior partner in the Mason City, Iowa, firm of Wallace and Holland, is the new president of the Iowa Association of Consulting Engineers. He was elected at the group's annual meeting in Des Moines.

Terence P. Curran has been appointed to the New York State Civil Service Department as associate engineering examiner at Albany, N.Y. A recent graduate of Manhattan College, Mr. Curran was until lately with the New York City Board of Water Supply on the Cannonsville Dam Project.

Nathan E. Way, recently named assistant to the chief engineer of the Tennessee Valley Authority, served this winter as a member of an official U.S. delegation to Colombo, Ceylon, and was an active participant in the fourth ECAFE regional conference on water resource development.

Alfred R. Golze retired on February 20 from the U.S. Bureau of Reclamation, where he has been assistant commissioner since 1958, to accept the position of chief engineer of the California State Department of Water Resources. Mr. Golze served the Bureau as assistant director of the Branch of Operation and Maintenance from 1945 to 1947 and as director of the

Program and Finance Division from 1947 to 1958.

Theodore von Karman, Honorary Member of ASCE and one of the world's leading aeronautical engineers, recently received the honorary degree of doctor of science from Brown University. Dr. von Karman, who created and for a decade served as chairman of the NATO Advisory Group for Aeronautical Research and Development, addressed the convocation on the subject, "NATO Cooperation in the Aeronautical Sciences."

David Dick, chief building inspector for the City of Roanoke (Va.) from 1948 to 1953, when he opened an engineering office at 3318 Williamson Road, N.W., has now formed an engineering-land survey firm at the same address. Mr. Dick was recently reappointed to a four-year-term on the Roanoke City Planning Commission.

Frank Giuliano and **Leon Nadolski** have formed the partnership of Giuliano and Nadolski with offices at 700 Montgomery Street, San Francisco, Calif. Mr. Giuliano has been in private practice since 1959 and Mr. Nadolski, for the last seven years, has been with the Bechtel Corporation of San Francisco.

William F. Reardon, who has been connected with real estate and construction since joining the General Electric Company in 1948 as estimator and assistant to the manager of engineering, has now been named western region construction manager at G.E. His headquarters will continue in Schenectady where he has been design standards and review engineer since 1953.

George W. Kenderes has been advanced to assistant district foreman at the Bethel Park (Pa.) warehouse of the Manufacturers Light & Heat Company, after serving three years as district engineer at Mt. Lebanon. His successor, **Robert N. Ames,** was formerly assistant district engineer at Mt. Lebanon. Both men joined the firm as engineers at Pittsburgh in 1953.

Datus E. Proper was recently honored as "Engineer of the Year," by the Bexar Chapter, of the Texas Society of Professional Engineers.

While Mr. Proper is currently executive vice president and general manager of the Pearl Brewing Company, and is not actively engaged in engineering as such, he has served in the past as executive vice president of the Texas Good Roads Association and from 1942 to 1954 was a member of the Texas State Board of Registration for Professional Engineers.

(Continued on page 24)

News of Members

(Continued from page 23)

Henry Martyn Paynter is now associated with Charles A. Maguire & Associates, of Providence, Boston and Hartford, as a consultant. Dr. Paynter, an associate professor in mechanical engineering at the Massachusetts Institute of Technology for the past 14 years, has vast academic and practical experience in the application of analog and digital computers to the solution of complex problems in all fields of engineering. He is a holder of a Doctorate in hydroelectric engineering, having earned this degree from M.I.T. in 1951, and is a recipient of the Alfred Noble Prize.

Warren A. Gentner has retired as chief engineer and deputy manager of the Water Bureau of the Metropolitan District at Hartford, Conn., after 47 years of service. His retirement has resulted in the promotions of **Gilbert U. Gustafson** to deputy manager for engineering; **Sherman L. Rogers,** to deputy manager for distribution; and **Alexander J. Minkus**, to deputy manager for supply and purification.

Melbourne A. Forrest, vice president of Burns and Roe, Inc., New York City engineers and constructors, has been elected to the company's board of directors. In addition to responsibility for the firm's project operations in the power, nuclear, and industrial fields, Mr. Forrest has charge of defense and aeronautical facilities.

James A. Cummins, owner of the Robert J. Cummins Company, an engineering firm established by his late father, Robert J. Cummins, Hon. M. ASCE, has been named "Outstanding Young Man for 1960" by the Houston (Texas) Chamber of Commerce. The firm is structural designer for the 31-story First City National Bank building now nearing completion in Houston, said to be the tallest all-welded steel frame in the world.

T. Y. Lin, professor of civil engineering at the University of California at Berkeley, and a partner in T. Y. Lin and Associates at Van Nuys, Calif., attended the executive committee meeting of the International Federation for Prestressing, recently held in Rome, where plans for the Fourth International Congress on Prestressing were discussed. While abroad, Professor Lin spoke before the Cement and Concrete Association of Great Britain on "Recent Development of Prestressed Concrete in the U.S.A."

Peter J. Accorti, Major, U.S. Corps of Engineers, has been assigned as deputy district engineer of the Nashville District. Major Accorti, who rose from the ranks to become a commissioned officer, served in both World War II and Korea. From 1956 to 1960 he served a four-year tour in the Programs Division at Supreme Headquarters, Allied Powers (SHAPE) in Paris.

Allen F. Clark, Jr., recently retired Brigadier General and division engineer of the North Pacific Division of the Corps of Engineers, in his new capacity as managing director for the Harza Engineering Company in West Pakistan, has charge of a ten-year water resource development program, known as the Indus River program. The billion-dollar development program is being financed by the World Bank under an agreement signed by India and Pakistan, and construction is scheduled to begin this year.

Murray G. Albertson, until recently director of the sanitary department of the Pease Company in Stamford, Conn., now maintains a consulting practice at 14 Englewood Road, Rowayton, Conn. From 1954 to 1956 he was a sales engineer with Dorr-Oliver, Inc., in Stamford, and subsequently was assistant to the vice president of Richard Dudgeon, Inc., of Brooklyn, with responsibility for the design and manufacture of pumps and special hydraulic systems.

Gerald T. McCarthy (see photo), senior partner of Tippetts-Abbett-McCarthy-Stratton, New York, has been elected president of the American Institute of Consulting Engineers, for 1961. **Harold M. Lewis,** consulting engineer, New York, is first vice president. **David G. Baillie, Jr.,** partner, Singstad & Baillie, New York; **James P. Exum,** partner, Howard, Needles, Tamman & Bergendoff, New York; and **Howard J. Williams,** vice president, Fay Spofford & Thorndike, Boston, have been elected to serve three-year terms on the Institute's governing council.

Ralph C. Graber recently was named assistant chief of the newly formed Division of Air Pollution of the U.S. Public Health Service, Washington, D.C. Formerly, he was chief of the now-extinct Air Pollution Engineering Branch of the Division of Engineering Services.

Kenneth V. Marr, after twelve years with the California firm of Arthur A. Sauer and Associates, recently was made a partner in the firm. Mr. Marr, a civil and structural engineer, is in charge of the firm's Sacramento office.

W. D. Kimmel, who from 1937 until his retirement last year was district engineer for the Portland Cement Association with headquarters at Milkwaukee, is now serving as liaison representative engineer between principals of the W. T. Collings engineering firm in Milwaukee and their clients.

Elmer K. Nelson will retire from full-time duties with the U.S. Senate Committee on Interior and Insular Affairs on

April 1. Mr. Nelson was appointed to his current position of staff engineer to the Senate committee 14 years ago. Mr. Nelson expects to continue his consulting practice and will remain in the Washington, D.C., area. He resides at 906 South Saint Asaph Street, Alexandria, Va.

Clay Colley, consulting engineer of Los Angeles, Calif., is currently engaged in his specialty of materials handling and dust control as consultant to five nationally known industries and mining operations extending from Louisiana to the Pacific Coast.

John G. R. Clegg, after several years of experience in land development engineering in the San Francisco Peninsula area, has opened a consulting office at 1047 Alameda de las Pulgas, Belmont, Calif.

John S. Abel retired recently as manager of the engineering department of the Weyerhaeuser Company in Tacoma, Wash. He became Weyerhaeuser's chief engineer in 1943 after some 23 years in the field of power station and industrial design and construction.

Michael A. C. Mann is now computer applications engineer for the Multnomah Data Processing Center in Portland, Ore. Prior to joining the data processing firm last December, he was a computer engineering applications consultant in the San Francisco area.

Carl F. Mau retired last February as vice president of the California Water Service Company, San Jose, Calif. Mr. Mau, who joined the utility company in 1937, was elected vice president in 1941. His past engineering experience includes employment as city engineer for Redding and Mount Shasta City, Calif., and as county engineer for Shasta County.

Robert S. Sherman has been promoted from design engineer to chief engineer of the Carolina Steel Corporation, at Greensboro, N.C. Prior to joining Carolina Steel in 1959 he was an independent consulting engineer.

Arthur G. Albertson, since 1952 a contracting engineer with the Chicago Bridge & Iron Company, has been transferred from Los Angeles to the New Orleans sales district. At the same time **Stanley V. Whitehead,** a contracting engineer with the company since 1955, moves to Kansas City from Chicago.

Abraham S. Neiman has retired from full-time service as structural engineer for the Directorate of Civil Engineering of the U.S. Air Force at headquarters in Washington, D.C. However, he has been retained by the Air Force as a civil engineering consultant for the design of protective structures. His address is 400 South Beverly Drive, Beverly Hills, Calif.

(Continued on page 26)

News of Members

(Continued from page 25)

Frank Patterson was recently in Cairo as ARAMCO'S representative to an international city planning and urban development seminar sponsored by the Egyptian Society of Engineers and the Congress for Cultural Freedom. As coordinator of home ownership and community development in the firm's Arab development department, Mr. Patterson has participated in the assistance ARAMCO has given to local municipalities in the Arab countries since 1952.

Charles H. Grisemer, for the past ten years on the sales engineering staff of the American Bitumuls & Asphalt Company, a subsidiary of Standard Oil of California, is now staff engineer in the San Francisco home office of American Bitumuls & Asphalt. Prior to his present appointment, he was resident manager in the Columbus, Ohio, office.

Harold W. Hansen has taken the position of senior planning engineer of the Paving Bureau of the Portland Cement Association, with headquarters in Chicago. In a 20-year civil engineering career Mr. Hansen has held important positions with both government and private organizations. From 1953 to 1956 and, again, from 1959 to 1960 he was with the Automotive Safety Foundation in various capacities.

Mario Savelli has been elected a Fellow Member in the Historical and Geographical Institute of Sao Paulo, Brazil. His qualifications include extensive writing and lecturing on the industrial development of Brazil from the earliest manufactures to its present industrialized state. Mr. Savelli is president of the Brazil Section of ASCE.

Harold E. Atherstone, associate highway engineer in the division of highways of the California State Department of Public Works, has been appointed by the board of directors of the California Society of Professional Engineers to the office of executive secretary of the Society. Mr. Atherstone succeeds **Leroy Martin** in the post.

Eugene Kasper recently became city commissioner of engineering and construction for Toledo, Ohio. As project engineer for the Toledo district of the Ohio State Highway Department since 1954, he has been in charge of construction for much of the Toledo expressway system.

Richard R. Mayer has opened an office to practice surveying at 323 Foster Street, Fort Atkinson, Wis. Mr. Mayer earned his B.A. at Ohio Wesleyan University and his master's in geodesy, photogrammetry and cartography at the Ohio State University, and, until recently, was with the Ohio State Department of Highways at Columbus.

Uel Stephens, director of the Fort Worth (Texas) Water Department, has been appointed by Texas Governor Price Daniel to serve for a four-year term on the six-member State Board of Registration for Professional Engineers. Mr. Stephens, in the late thirties, was instrumental in having legislation passed creating the board.

B. Edward Prescott, Jr., recently joined the firm of Shepherd & Worthington, Inc., as its chief design engineer. As a result of this new association the firm, which maintains offices at 8226 Fenton Street, Silver Spring, Md., has changed its name to Shepherd, Worthington & Prescott, Inc.

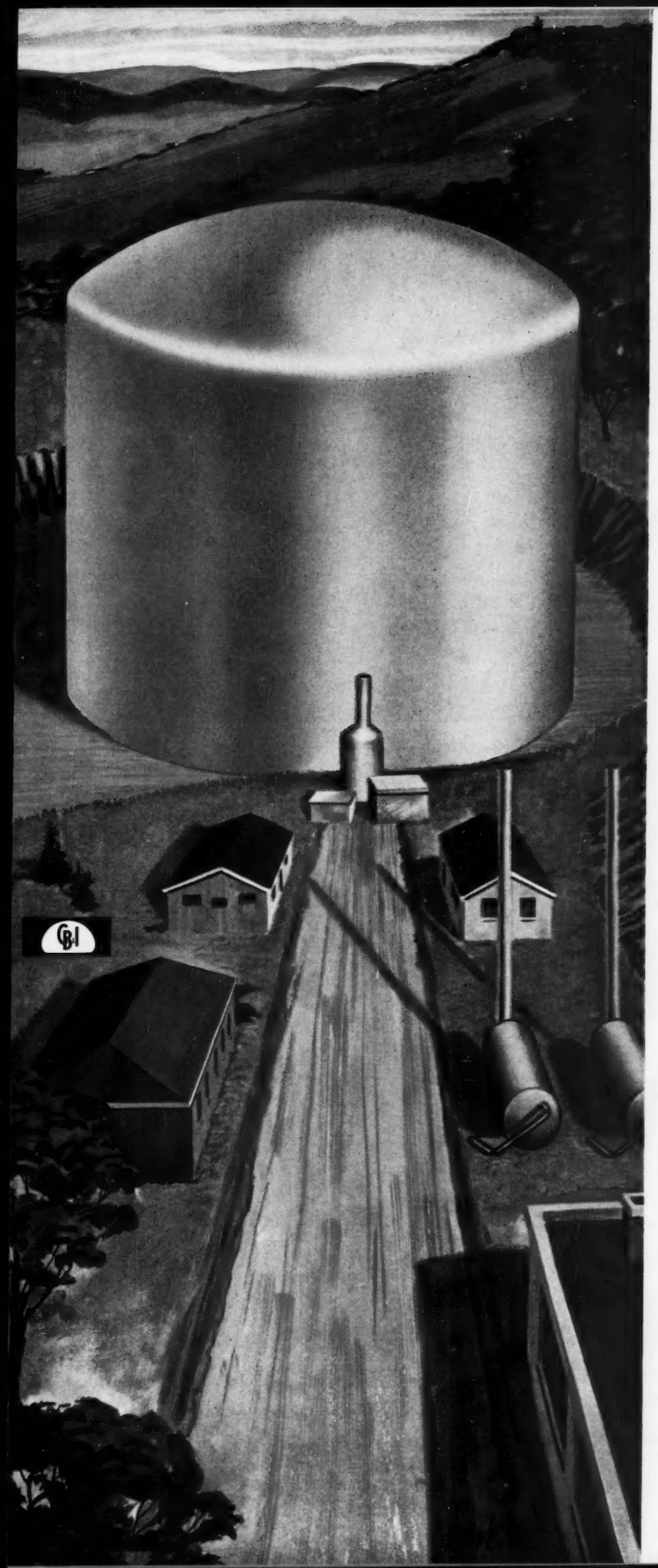
Emory L. Wilson has been named manager of the Pine Hall Brick and Pipe Company's Clay Pipe Sales Division to succeed his father, **Fred Wilson,** who recently retired after 28 years with the company. The younger Mr. Wilson has served as clay pipe sales engineer since 1953.

Alfred B. Osterhues was recently appointed chief engineer and planner for Cabot, Cabot & Forbes, Inc., which is developing 7,102 acres of planned communities owned by the Laguna Niguel Corporation along the Orange County coastline in Southern California. Before joining Cabot, Cabot & Forbes, Mr. Osterhues engaged in the design of highways, freeways, sewers and storm drains for the State of California and Los Angeles County.

Joseph M. DeSalvo has been admitted to general partnership in the consulting firm of Joseph S. Ward and Associates, at Caldwell, N.J. Mr. DeSalvo has been with the firm since 1952, most recently as chief engineer. He is, also, vice president of Joseph S. Ward, Inc., Caldwell, and executive vice president of the Philadelphia affiliate, Joseph S. Ward and Associates, Inc.

John F. Michel recently opened an office for the practice of engineering and land surveying in the Engle Building, 3401 Main Highway, Coconut Grove, Miami, Fla. For the past three years Mr. Michel has been an associate of Rader and Associates of Miami, where he headed the Land Planning Department and served as project manager on land development, port and highway projects.

Wendell E. Johnson, since 1949 chief of the engineering division of the Missouri River Division of the Corps of Engineers at Omaha, Nebr., is the new engineering division chief of civil works in Washington, D.C. He has been with the Corps for most of the years since 1933, with time out from 1940 to 1945 to serve as chief of the construction division on the Third Locks Project of the Panama Canal and as a major in the U.S. Army during World War II.



Unique Refrigerated PROPANE Storage System

WILL REDUCE COSTS OF DOUBLING PEAK SHAVING CAPACITY

A 120,000 bbl. propane storage tank will be the heart of a refrigerated facility for liquefied gas under construction at Minneapolis Gas Company.

The facility employs a unique approach in self refrigeration. Purging and control problems are reduced by condensation of vapors at less than ambient temperatures.

The double wall steel tank stores 120,000 bbls. at −50°F, the equivalent of 137,500 bbls. at +60°F. The outer tank will be 106 feet in diameter and 100 feet high.

Storing propane as a liquid for peak shaving is less costly than contracting for additional natural gas. The initial cost of conventional above-ground pressure storage would be about 3 times the cost of this refrigerated facility.

Fully refrigerated storage was selected for the new facility for (1) economy, (2) ease of expansion and (3) the ability to locate the facilities exactly where they would do the most good.

CB&I has complete responsibility for design, fabrication, erection and start up of the refrigeration plant and storage facility.

Write for our Brochure G-48, "Refrigerated Storage Facilities."

Another achievement in low-temperature storage

CB&I

Chicago Bridge & Iron Company
332 South Michigan Ave., Chicago 4, Ill.
Offices and Subsidiaries Throughout the World

CB-617

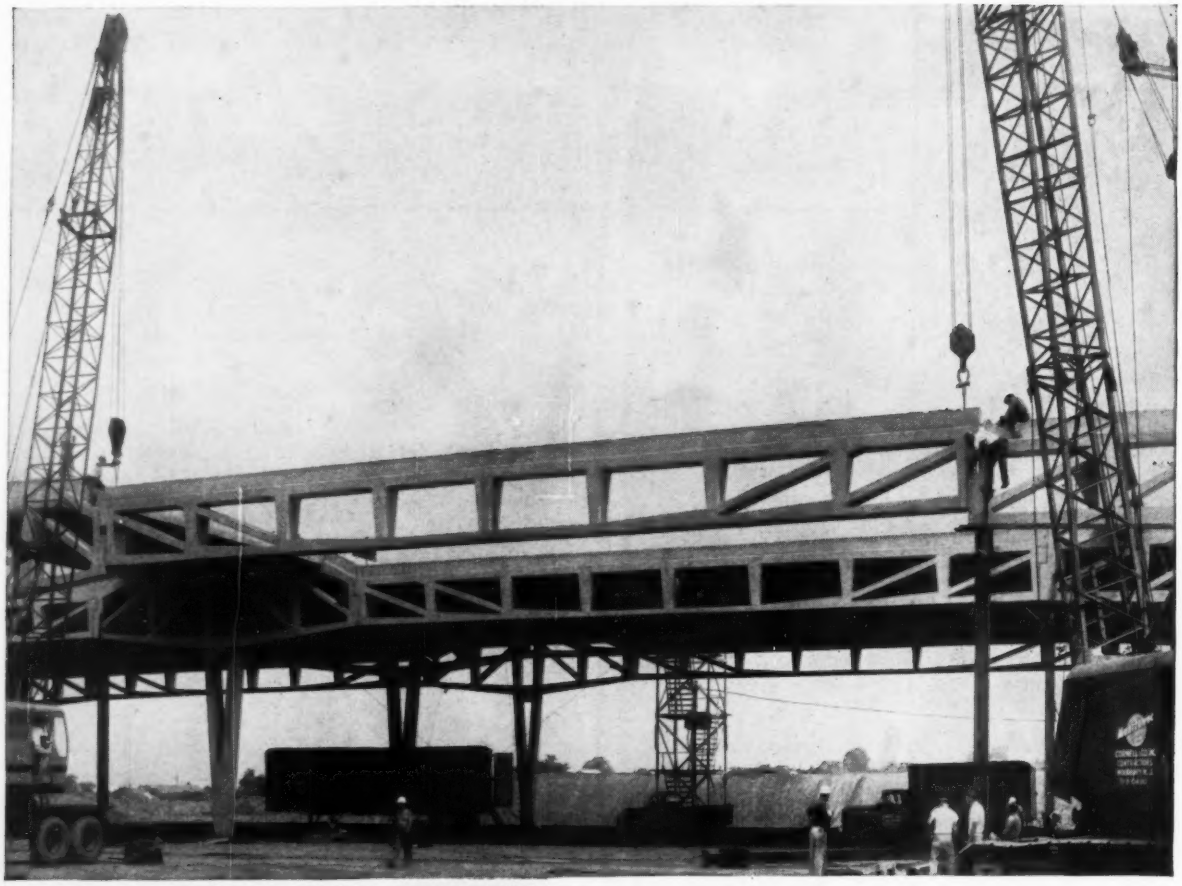
. . . . . Am-Soc Briefs

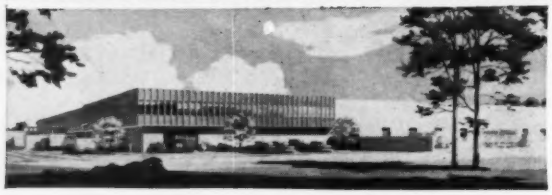
▶ ▶ With improved weather, work on the United Engineering Center is being pushed—toward an August completion date. At the end of March the interior walls were being plastered and final touches put on wiring and plumbing systems of some floors. Occupancy is now scheduled for September, with a UEC open house to be a feature of the Annual Convention. . . . On the financing end, the Mechanicals and Electricals and the American Welding Society are each within $25,000 of their goals. The Civils and Chemicals are each $19,000 over, and the Industrial and Consulting Engineers are also over. It is now evident that $500,000 to $750,000 more will be needed to complete and furnish the building than is available from funds on hand and pledged. . . . The Society is sending framed color prints of the Center to ASCE Student Chapters whose contributions were received before the close of its official campaign in August as a token of appreciation.

▶ ▶ Conference calendar. . . . Too late to say more about the Phoenix Convention, which will be in full swing (April 10-14) as this issue comes off the press. But upcoming later in the month will be the Thirteenth Annual Pacific Northwest Council Conference, to be held in Spokane, Wash., April 20-22, conveniently dated for travel-minded Phoenix Convention visitors who want to see the Northwest, too, before returning home. For engineers concerned with the swift pace of developments in two relatively modern fields, there are two important Technical Division Conferences—the Air Transport Conference, set for Miami Beach, May 8-12, and the Engineering Mechanics Conference, in Troy, N. Y., May 18-19.

▶ ▶ For sale. . . . Coupons appear in the advertising section of this issue to aid members in ordering three important new Society publications: "Symposium on Penstocks," reprinted from the Power Division Journal; "Civil Engineering Education," the proceedings of the Joint Conference on Civil Engineering Education, held in Ann Arbor last July; and the Cumulative Index to ASCE Publications, the first joint and first cumulative guide to Proceedings, Transactions, and Civil Engineering.

▶ ▶ Best-kept secret. . . . As many engineers are well aware, they are sometimes overlooked when it comes time to parcel out credit for a project. In too many public relations releases received at ASCE headquarters, the architect gets a hand, as does the contractor and, sometimes, the steel fabricator, but the role of the engineer is ignored. Occasionally even the public relations departments of large engineering schools are guilty of such oversight. Editors insisting on using the name of the engineers frequently must phone and phone and phone again. Sometimes such attempts are futile, and always they are time consuming. . . . It will be much better for you—as well as easier for editors—if you will contact those who may be issuing releases before they go out instead of feeling left out later.





Post-tensioned Vierendeel truss 80 ft in length designed by A. E. Komendant being set by cranes between 20-ft cantilever sections creating 120-ft span. By this method, Merchants Refrigerating Co., freezer plant at Secaucus, N. J., was constructed with clear spans 120 ft in length, and bay areas of 5000 sq ft. Savings in time and cost were also achieved. Designers and Engineers: Abbott, Merkt & Co., New York City; General Contractor: Turner Construction Co.; **Prestressed Concrete Fabricators: Atlantic Prestressed Concrete Division, Warner Co., Trenton, N. J.**

PRESTRESSED CONCRETE SAVES COLD CASH FOR LARGE REFRIGERATING COMPANY

Redesigning a new 440 x 360-ft cold storage room with prestressed concrete led to some interesting advantages for Merchants Refrigerating Co., of Secaucus, N. J.

First, use of post-tensioned 80-ft drop-in spans set between 20-ft cantilevers resulted in spacious, column-free bays. Then, designing the supports as V-shaped columns helped to overcome effectively the 100°F differential between summer erection and a −10°F operating temperature. Insulation, too, became a much simpler matter with prestressed, and sub-zero painting problems were eliminated.

Costs for this prestressed concrete structure were competitive with alternate designs. In addition, this method reduced fabrication and erection time by two months.

Achievements like this have a familiar ring when prestressed concrete is used for virtually any kind of structure. Fireproofness, strength and extremely low upkeep are other advantages. In planning your next building, it will pay you to give prestressed your *first* consideration.

Roebling has led the way in developing and promoting prestressed's advantages from its early beginnings in this country. Besides the finest pretensioning materials, Roebling today can offer you a wealth of design data and practical experience unequalled in the prestressed industry. For constructive information on any aspect, contact Roebling's Construction Materials Div., Trenton 2, N.J.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

do you know that

Cost estimates for completing the National Highway Program remain unchanged? Despite rising costs in other sectors and pessimistic predictions of runaway costs, the Department of Commerce says that the original estimate of $41 billion still stands. Of this, $37 billion is estimated as the Federal Government's share. Incidentally, since initiation of the highway program in 1956, over 50,000 construction contracts have been awarded for it and a million and a half workers have been employed on it.

■ ■ ■

Trash disposal is one of New York City's major problems? Many different agencies have handled the job for the city since Colonial times, when pigs were allowed to roam the streets and eat the refuse thrown there. The present Department of Sanitation, created in 1930, has 13,500 employees and an annual budget of more than $100,000,000. The enormous quantity of refuse collected is burned in incinerators that can process up to 1,000 tons a day. Incineration waste is trucked to landfills, which ultimately become valuable reclaimed areas.

■ ■ ■

The space age needs civil engineering know-how? Modern civil engineering techniques have been employed to meet the rigid requirements of a large fixed radio telescope at Danville, Ill. How civil engineers contributed to the design and construction of this unusual space research tool will be reported in the May issue by the project engineer and the design engineer on the job.

■ ■ ■

In this century the population of the U.S. has increased 135 percent? The actual gain is from 76.2 million in 1900 to 179.3 million in 1960, according to recent census revelations. Of the nation's four major regions, only the West—with a population increase of 550 percent—has exceeded the national rate of gain. In the past decade there has been a sharp drop in farm population, from 16.6 percent of the nation's total in 1950 to 8.7 percent of the total in 1960.

■ ■ ■

Companies expect to hire more engineering graduates this June? In a recent Northwestern University survey of employment possibilities, 210 average-to-large companies reported that they will hire 5.9 percent more engineering graduates in 1961 than last year but 3.2 percent fewer non-technical graduates than they did in 1960. Starting pay for engineers is expected to be about $520 per month, compared with an average starting salary of $510 for last year's graduates.

■ ■ ■

Of all the men in history who would qualify as scientists, 90 percent are alive today? This startling fact was mentioned by Ellis L. Armstrong, F. ASCE, until recently commissioner of the Bureau of Public Roads and now president of the Better Highways Information Foundation, in an address before the National Bituminous Concrete Association.

■ ■ ■

Electronic sentinels are monitoring the condition of the Delaware River? Automatic instruments have been installed at four points along the lower Delaware to keep a 24-hour check on pollution, temperature, salinity, and other important river conditions. These devices are the latest step in a long-range program of river study started in 1949 by the City of Philadelphia and the U.S. Geological Survey. They will make the Delaware the first tidal estuary in the country to be monitored electronically for water quality on a permanent basis.

■ ■ ■

A new type of snow plow can make airstrips, too? This winter the U. S. Army Snow, Ice and Permafrost Research Establishment has been testing a versatile snow plow on making airstrip runways in the Arctic. The machine—consisting of a Snowblast Rotary Plow, mounted to a D-6 Caterpillar Tractor and powered by a diesel engine—picks up powdered snow, compacts it, and deposits it again as a hard, smooth surface, solid enough to support aircraft landings.

■ ■ ■

Aluminum is having its diamond anniversary? In February the aluminum industry celebrated the 75th anniversary of the development of the electrolytic process for the recovery of aluminum. The process—developed by Charles Martin Hall in his early twenties—transformed an expensive laboratory curiosity into a versatile, reasonably priced metal with wide possibilities. Only 280 tons of the lightweight metal were produced in the nine-year period, 1883-1892, whereas the 1960 production figure was around 2,000,000 tons.

■ ■ ■

Pittsburgh's retractable dome amphitheater will be the largest domed building in the world? The spectacular structure, three times the diameter of St. Peter's in Rome, will be finished this summer. The June issue will carry the full story on the structure by the resident engineer who has worked on it since inception of the project. The problem of making and moving huge metal leaves to provide an area open or closed as weather permits, has facets of interest to all engineers.

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SURVEYING— its current status in civil engineering

EARLE J. FENNELL, F. ASCE
Member and Past Chairman, Executive Committee, ASCE Surveying and Mapping Division; Associate Chief Topographic Engineer, Geological Survey, U. S. Department of the Interior, Washington, D.C.

A question of ethics led ASCE, in 1953, to undertake a study to determine which parts of surveying and mapping are professional, and further, which of those professional parts should be considered civil engineering. The study culminated in a final report, from which a policy pronouncement was made by ASCE in February 1959. Briefly, the Society declared that land, engineering, geodetic, and cartographic surveying are civil engineering. (See CIVIL ENGINEERING, May 1959, vol. p. 348.)

There has been general acceptance of this policy in so far as engineering, geodetic and cartographic surveying are concerned. In the field of land surveying there is not such general acceptance. This may be because land surveying involves more private practitioners than geodetic and cartographic surveying and is not so intimately associated with civil engineering construction as engineering surveys. It is probable, too, that the lack of acceptance stems from the fact that property-line surveys and land subdivision constitute a sizeable part of the field of land surveying, and that kind of work is frequently done by apprentice-trained surveyors rather than by men trained as civil engineers.

Inevitably any change in the status quo encounters resistance. This is understandable. From informal sources, it is understood that the Professional Status Committee of the American Congress on Surveying and Mapping, which was assigned the task of studying the ASCE policy statement, is finding considerable evidence of concern on the part of land surveyors. This concern is probably over three points in the Final Report of the ASCE Task Committee to the Board of Direction (published as ASCE Proceedings Paper 2166, in the September 1959 Journal of the Surveying and Mapping Division). These three points are that: (1) land surveying is civil engineering, (2) a basic engineering education should be a prerequisite for all land surveyors in the future, and (3) all who wish to practice property surveying should be basically engineers and should have had a B.C.E. degree or the equivalent.

Fear of usurpation

Land surveyors probably fear that civil engineers are trying to usurp their place. On the other hand, civil engineers are likely to become concerned

over the inclination on the part of some land surveyors to include such functions as the design of street systems and water and sewer facilities in the practice of land surveying. Can these views be reconciled? No doubt they can, if the proponents on each side take an objective view of the situation.

As far as usurpation of the field of surveying by any and all civil engineers is concerned, at no time has an authoritative voice suggested that it would be proper for every civil engineer to practice land surveying. Rather, a civil engineer should do so only when he has proved his competence by his qualifications, experience and observance of professional ethics.

In regard to the concern of civil engineers over the extent to which such functions as street, water and sewer layouts are carried out by land surveyors, it is not likely that an old-time retracement surveyor would launch out into the design of streets, grades, or water and sewer systems without first mastering the principles of highway and sanitary engineering, hydraulics, soil mechanics and, to some extent, structural design. If he has mastered these principles by one means or another to the extent that he can do a creditable job under most circumstances, he would very likely be eligible for registration as an engineer, and would probably meet the standards for membership in ASCE.

No doubt these differences will be reconciled in time. The need for higher standards of professional training is evident on every side. If high standards are ignored in any branch of surveying, it will be detrimental to the profession as a whole.

Education and training needed

It is generally recognized that the practice of land surveying involves certain knowledge that is not entirely obtained through formal college training. In addition to a knowledge of techniques and instruments, which may be obtained through an engineering education, the land surveyor should know the local customs pertaining to boundaries, boundary markers, etc., and perhaps of paramount importance is his knowledge of the legal aspects of property matters. Some of this knowledge can be obtained from study in school but much of it generally comes from special study and experience. It would seem that ideally the practitioner should possess an educational background in civil engineering and also such knowledge of local conditions and legal aspects as comes from special study and experience.

Why is an education in civil engineering desirable for the land surveyor? Because it is the course of study generally available which contains subject matter bearing directly on the practice of surveying, and which contains other subject matter that is indirectly, but quite closely, related to it. All agree that a man can never learn too much. Anyone who contends that little, if any, advanced learning is required for practice in as complex a field as land surveying is taking an extremely narrow view of the matter. If such a view becomes prevalent, it will surely be prejudicial to the best interests of surveying and of civil engineering.

From time to time excellent articles have been published on the status of surveying and mapping in college curricula. As one would suspect, many of these articles have been written by educators. Some of them are quite critical of the colleges for failing to include "adequate" training in surveying. The fault may not lie entirely with the colleges.

Deficiencies in surveying and mapping education are in part the fault of those in practice. If practitioners fail to demand high standards of professional training for those who wish to practice, the colleges can hardly be expected to provide such training. It is true that only a relatively small number of engineering graduates may find employment in the field of surveying and mapping, but it is also true that those so employed will be in greater demand, and command greater respect, if they are properly educated and trained.

Many excellent papers are available on engineering education. In the field of surveying and mapping these include papers by such authorities as John Scalzi formerly of Case Institute, Kenneth Curtis of Purdue University, Brother B. Austin Barry of Manhattan College, Jesse Fant of the University of Minnesota, Russell Brinker of Texas Western, and Arthur McNair of Cornell University. (All are members of ASCE.) Also available are the reports of the American Society for Engineering Education, the Task Committee on Professional Education of ASCE, which published a report in the February 1958 issue of CIVIL ENGINEERING (vol. p. 111), and the report of the Colloquium on Survey Education, sponsored by the Canadian Institute of Surveying in 1959 at Ottawa. From these sources the following points are evident:

1. Instruction in surveying, as well as in other fields, should move from the "how-to-do-it" to the "why-it-can-be-done" aspect.
2. A broad base in the engineering sciences is required and a more comprehensive study of the humanities.
3. Graduates of a full college program of this nature will be educated in theory, but will need additional training on the job to become productive.
4. The advent of electronics in surveying will require changes in curricula.
5. Courses of study in surveying should be included in the later years of study and should be given by well qualified personnel.

The foregoing points represent a consensus of sorts. Although there is general accord in the matter of a broad, scientific education, there is also support for retaining the teaching of the practical aspects of surveying, inasmuch as "down-to-earth" practice is the outlet for 85 percent of the undergraduates. It is generally agreed that technician-type work should be done by technicians, thus releasing engineers for projects that require their broader knowledge. It follows that an appropriate course of study should be provided for technicians.

The future outlook

What is the outlook for engineers who want to work in the field of surveying and mapping? It seems to be a rather promising future if a broad concept of surveying is accepted which takes into account the surveys required in space exploration and oceanographic studies. There are good opportunities even in the more narrow current concept, which is usually confined to conventional work in land, geodetic, engineering, and cartographic surveying. These opportunities exist in public agencies, such as state and federal services, and with the several thousand surveyors and surveying firms in private practice throughout the country. A casual check with some of the federal agencies in Washington that carry on surveying indicates that about 300 to 400 professional engineering civilian personnel should be hired each year for positions that could lead to responsible charge in surveying, mapping and charting operations.

It should be emphasized that it is a duty of professional societies to set high standards of qualification and performance. These standards may be compromised from time to time, but in the long run insistence on high principles will benefit the profession through better protection of clients' interests.

(This article is based on the paper presented by Mr. Fennell at the Surveying and Mapping Conference held last June at Camp Benham, the field camp of Oklahoma State Univ., in Buena Vista, Colo.)

PROFESSIONAL INCORPORATION?

An editorial reprinted by permission from
THE JOURNAL OF ACCOUNTANCY,
October 1960

In the July issue of the *American Bar Association Journal,* René A. Wormser proposed that lawyers and members of other professions be permitted to incorporate under special state laws which would require that every stockholder in such corporations should be a member of the profession in good standing, and that each stockholder assume full personal responsibility for all professional acts of the corporation.

Radical as it seems at first glance, this proposal is at least worth thinking about. It serves to point up the fact that corporations have been given tax and other advantages which are unavailable to proprietors and partnerships. Among them, Mr. Wormser lists these:

1. An election, under Subchapter (S) of the Internal Revenue Code, to be taxed as a partnership or as a corporation
2. Opportunity to create a qualified pension or profit-sharing plan or both in which principals can participate
3. Opportunity to create deferred compensation plans for principals as employees
4. Availability of stock option and stock bonus plans for promising younger members of the firm
5. Other "fringe" benefits

Among possible fringe benefits, not specifically listed by Mr. Wormser, are corporate insurance on the lives of stockholder-executives, and tax-free payments up to $5,000 to the widow or other beneficiaries of a deceased employee's estate.

There are, of course, strong arguments against corporate practice by members of the professions, and they are buttressed by traditions which no one would lightly set aside. Acceptance of personal responsibility by professional practitioners is by no means the only point at issue. H. Bradley Jones, in the Autumn 1958 issue of the *Fordham Law Review,* quoted a court opinion (198 N.Y. 479, 92 N.E. 15, 1910) which is applicable to other professions as well as to the law:

> The practice of law is not a business open to all, but a personal right, limited to a few persons of good moral character, with special qualifications ascertained and certified after a long course of study, both general and professional, and a thorough examination by a state board appointed for the purpose. The right to practice law is in the nature of a franchise from the state conferred only for merit. It cannot be assigned or inherited but must be earned by hard study and good conduct. It is attested by a certificate of the Supreme Court and is protected by registration. No one can practice law unless he has taken an oath of office and has become an officer of the court, subject to its discipline, liable to punishment for contempt in violating his duties as such, and to suspension or removal. It is not a lawful business except for members of the bar who have complied with all the conditions required by statute and the rules of the courts. As these conditions cannot be performed by a corporation, it follows that the practice of law is not a lawful business for a corporation to engage in. As it cannot practice law directly, it cannot indirectly by employing competent lawyers to practice for it, as that would be an evasion which the law will not tolerate. . . .

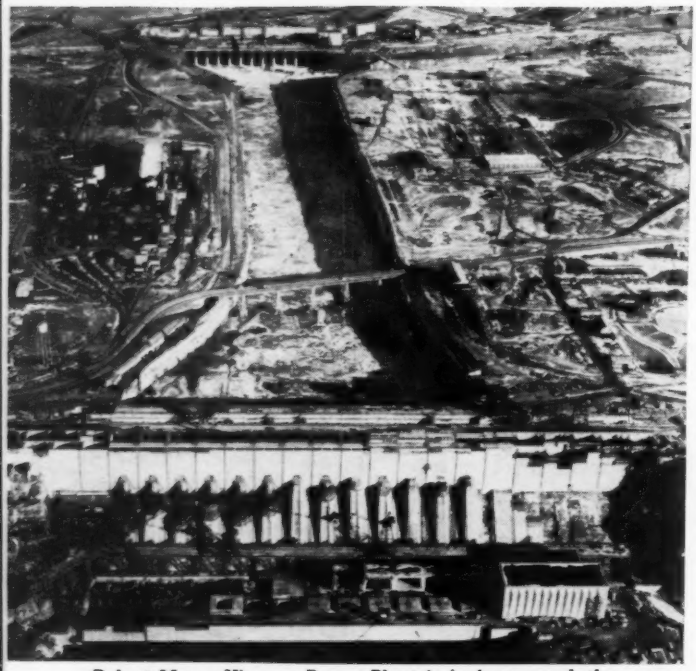
Nevertheless, Mr. Jones like Mr. Wormser believes that such arguments could be met by state statutes specifically drawn to include appropriate safeguards and restrictions on corporations all of whose stockholders were members of a single profession.

Both authors are frankly interested in the tax advantages of doing business as a corporation rather than as a partnership or proprietorship. Both also recognize that in some cases there might be tax disadvantages, including the possibility of double taxation of income. It should also be noted that under the present provisions of Circular 230, agents enrolled to practice before the Treasury may not be connected with an "accounting corporation" as officer, employee or stockholder.

The proposal for a new type of special corporation for professional men is given sharper significance by the fact that Congress allowed the Keogh pension bill to die, despite the fact that it was passed by the House of Representatives and reported (in another version) by the Senate Finance Committee. After ten years of intensive cooperative effort by the various professions and the other self-employed groups—and despite general agreement that it is needed to provide even a limited measure of tax equity for the self-employed—this long overdue measure still apparently lacks sufficient political appeal to get through Congress. No doubt it will be introduced once again next year, and after coming so close to passage it is certainly worth another try, but there is no guarantee of success.

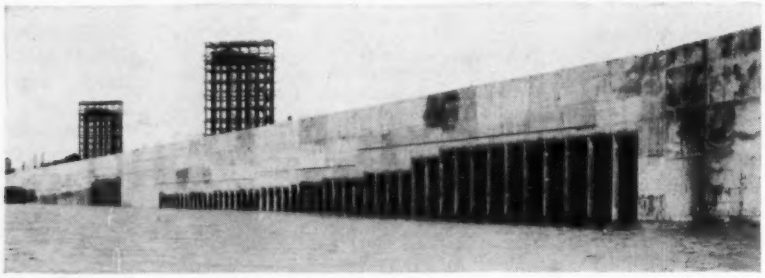
At the same time, therefore, the professional organizations which have worked so hard for the Keogh bill may decide to consider the alternative possibility of professional incorporation under state law. As Mr. Wormser suggests, enactment of such a law in one state would very probably be followed rapidly by similar action in the others. Nobody could argue that under such laws there would be anything inequitable about giving professional men the tax advantages now available to other corporate stockholder-employees. They would in fact be more restricted than other corporation executives.

On the other hand, advocacy of such laws would undoubtedly create serious public relations problems for the professions. No matter how carefully the proposed statutes were drawn, they could be subject to misinterpretation and misrepresentation. It may be that the potential disadvantages in the effect on public opinion outweigh the advantages in tax equity. Those who have achieved membership in a profession will certainly wish to think it over very carefully before advocating a step which might make them appear as wanting to have their cake and eat it too.



Robert Moses Niagara Power Plant is in foreground, then open canal connecting it with reservoir pump-generating plant.

At entrance to Intake No. 1, Power Authority Chairman Robert Moses stands between Asa George, Assistant Chief Engineer of the Authority, left, and the author, Col. William S. Chapin, its Chief Engineer and General Manager.



Twin intakes from Niagara River are seen 21 hours after first water flowed. Each intake is 700 ft long and has 48 slotted openings taking water from 13 to 26 ft below the surface.

The Niagara Power Project

WILLIAM S. CHAPIN

General Manager and Chief Engineer
Power Authority of the State of New York
New York, N. Y.

Power started to flow on February 10 from two of the 13 generators at the Robert Moses Niagara Power Plant at Niagara Falls, N. Y. In this 2,190,000-kw plant, costing $720 million, an additional generator will go on the line every five weeks until all are operating. A reservoir pump-generating plant, a feature of the project, will be ready for operation late in the year, when sufficient generators in the main powerhouse are working to utilize all the available water.

This hydroelectric plant, largest in the Western world, was built by the Power Authority of the State of New York. It was put in service in three years from the receipt of a workable license from the Federal Power Commission, on January 30, 1958. Financing was done through the sale of self-liquidating bonds to private investors and does not involve credit or grants from the state or federal government.

The great plant was built by a number of the nation's outstanding constructors, working on separate sections to complete the work in record time. Contracts for equipment and for field work were let in large blocks, many of them in the $20 million to $100 million bracket. One firm handled $170 million in contracts. Table I lists the major contracts for the work.

In many ways the Niagara plant is

unique. It is by far the largest hydro plant ever built in a busy industrial and residential area. Power had to be developed from run-of-the-river flow, taking the water as it comes without regulation. Long transmission lines tie the plant into the St. Lawrence project and a state-wide grid, and provide for interchange with Canadian plants.

By treaty with Canada, flow over Niagara Falls is to be permanently maintained at a rate that will preserve, and even enhance, the beauty of the Falls. This requires that a flow of 100,000 cfs be maintained over the Falls during the daylight hours of the tourist season and 50,000 cfs at other times. This comes from an average flow of 202,500 cfs, the water available for power being divided between Canada and the United States.

Operation without a dam is practical because the Niagara and St. Lawrence Rivers draw their water from the 300,000-sq mile tributary area of the Great Lakes, which forms the finest reservoir in the world, feeding the rivers so uniformly that the maximum flow is only about twice the minimum flow. This ratio is in great contrast to most other large rivers: 25 to 1 for the Mississippi, 35 to 1 for the Columbia, and 31 to 1 for the Ottawa. Despite the uniformity of the flow, the non-uniformity of the electric demand, the added 50,000 cfs of water available during night hours, and the complete lack of upstream storage make pumped storage an economic necessity—one of the unusual features of the project.

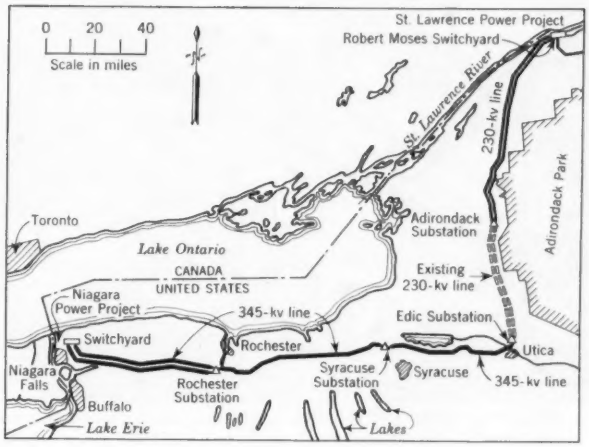


FIG. 1. A high-tension tie-line connects the Niagara and St. Lawrence power plants, increasing the firm capacity of both projects.

Robert Moses, dynamic chairman

The Niagara Power Project is being constructed by the same forces that recently completed the $650 million St. Lawrence Power Project, which won the ASCE award as the Outstanding Civil Engineering Achievement of 1960. The Power Authority of the State of New York did not possess a secret weapon to enable it to overcome all the obstacles in its way in financing, designing and constructing this billion-dollar self-liquidating project in the short period of six years. It did have the great abilities of its dynamic chairman, Robert Moses, who reorganized it and injected new life into it in 1954. With characteristic vigor he gave overall direction to the financing and prosecution of the work on an exceptionally rapid schedule. Mr. Moses, however, gives credit to the staff and the consultants responsible for the design, construction and daily direction of the work. The role played by Uhl, Hall & Rich, the principal engineering consultants, in the design and supervision of this project cannot be overemphasized.

The Power Authority itself consists of five trustees and a small supervisory staff of competent, dedicated people. It would have been impossible for the Authority to get together the design and supervisory staff needed for work of this magnitude even had there been the desire to do so. Chairman Moses followed a practice of many years standing in directing large engineering projects, of employing the best engineering and architectural consultants available. The engineers were given latitude to carry on the work without interference from the owner's staff or others. But the responsibility for getting results on a precise schedule was imposed upon them.

Canada shares water

Canada, through The Hydro-Electric Power Commission of Ontario, shares half the flow at Niagara, after some minor adjustments to equitably apportion water diverted into the Great Lakes by Canada and out of them by the United States. For years unnecessary controversies, both international and local in character, delayed authorization for the full utilization of Niagara water. However, Canada took earlier advantage of the Niagra treaty than did the United States and, in 1955, completed its Sir Adam

TABLE I. Major contracts for Niagara Power Project

Description	Contractor	Approx. Cost Millions of $
Intake and 8,000 ft of covered conduit	Merritt-Chapman & Scott Corp.	72
Covered conduit, 9,000 ft	Balf, Savin & Winkelman	38
Covered conduit, 5,500 ft	Gull-De Felice	34
Open canal, 4,000 ft, construction of reservoir	Kiewit, Morrison-Knudsen, Perini, Walsh	46
Power plant, general contract	Merritt-Chapman & Scott	100
Hydraulic turbines	Baldwin-Lima-Hamilton Corp. and Newport News Shipbuilding	21
Generators	Westinghouse Electric Corp.	21
Penstocks	Chicago Bridge & Iron Co.	11
Transformers	Ferranti Electric, Inc.	4
Reservoir pump-generating plant	Tuscarora Contractors (Arundel, Dixon and Hunkin-Conkey)	40
Pump turbines	Allis-Chalmers	12
Motor-generators	Allis-Chalmers	8
Niagara switchyard	Emerson Gordon Electric Co. and Day & Zimmerman	11

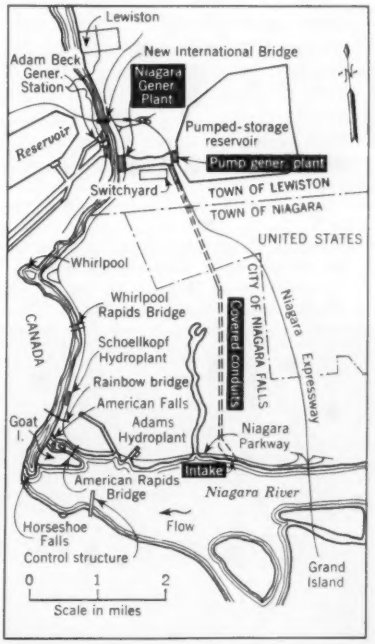
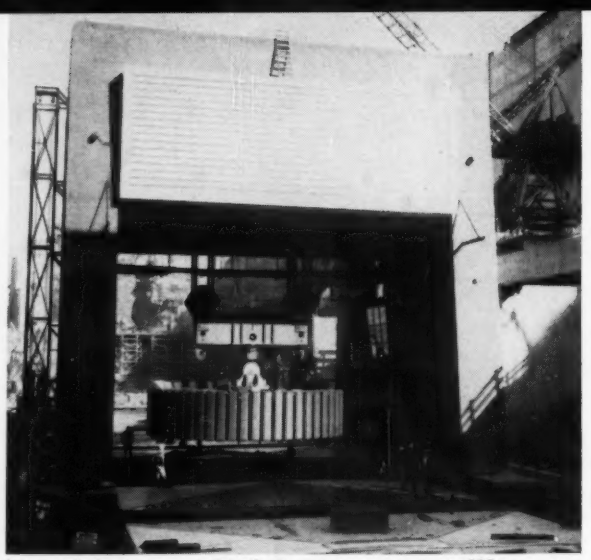


FIG. 2 Area map locates important features of project.

About 83 percent of total concrete had been placed in reservoir pump-generating plant in October 1960. Tailrace bridge piers and one lane of expressway deck are completed.



Suspended above unit No. 2 of main power plant, 595-ton rotor is about to be lowered into place inside a pit-mounted stator that provides only 5/8-in. clearance all around.

Beck Power Plant No. 2, which is only a little smaller than the United States Niagara Plant. (See "Canadian Power Development at Niagara Falls Nears Completion," by Otto Holden, M. ASCE, CIVIL ENGINEERING, Jan. 1956, vol. p. 6.)

Partial destruction of the Schoellkopf plant by a rock slide in June 1956 gave impetus to United States plans. However a clearcut go-ahead for the project could not be obtained until early 1958. The Schoellkopf Plant, and the G. S. Adams plant, that has been producing power from the Falls with the same equipment since 1895, will be retired since the new plant will more efficiently utilize the water available.

At the Falls the Niagara River drops spectacularly 160 ft. Before it reaches the Falls it drops some 60 ft through cataracts, and below the Falls it drops another 115 ft through several rapids. By taking the water from above the upper rapids, at about the level of Lake Erie, and discharging it near the level of Lake Ontario, 314 ft of the total 326-ft difference in water levels between the two lakes is utilized.

The bedrock structure in the area is comparatively simple, consisting of nearly horizontal layers of shale, limestone, dolomite and sandstone. These layers have remained stable since they were first deposited and are not folded or faulted. This situation simplified construction somewhat, but because the rock is known to be subject to some movement, and because of the failure that occurred at the Schoellkopf plant, excavation at the main Niagara generating plant was carried back at about a 45-deg angle.

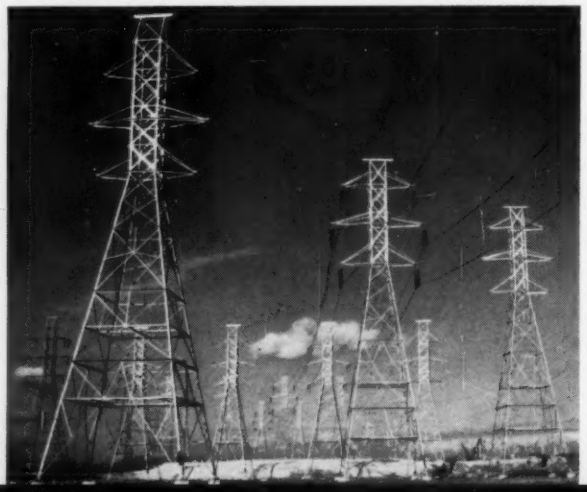
Maximum power from the available Niagara water is obtained by diverting the water 2½ miles above the Falls. Each of the two intakes is a concrete structure 700 ft long with 48 vertically slotted openings, which take the water from 13 to 26 ft below the river's surface. The structure acts as a fender to keep floating ice moving steadily downstream without entering the power intakes. Gates 49 ft wide and 68 ft high control the flow of the water to two parallel cut-and-cover tunnels which, lined, are 46 ft wide and 66 ft high. (See "Twin Conduits for Niagara," H. P. Cerutti, CIVIL ENGINEERING, July 1960, p. 50.) These tunnels carry the water 4¼ miles through cuts up to 150 ft deep, to an open canal, which forms the Niagara generating plant forebay. The latter is 4,000 ft long, 500 ft wide, and 110 ft deep. This serves the reservoir pump and generating plant as well as the major plant.

Robert Moses Niagara Power Plant

Located in the Niagara Gorge about 5 miles below the Falls, the power plant will have 13 vertical-shaft Francis-type hydraulic turbines. These have welded plate-steel spiral casings with cast-steel runner components welded into a unit. Each unit

Niagara Generating Plant is seen at end of open canal, with Sir Adam Beck Generating Station of Hydro-Electric Power Commission of Ontario on far side of Niagara River. In foreground Bailey bridge carries road across the canal.

Transmission lines for Niagara Power Project are seen looking north from the vicinity of Gibson Substation. The switchyard is located just south of the Open Canal. See Fig. 2. High-tension line connnects Niagara and St. Lawrence power plants



uses 6,250 cfs of water at best gate and 7,500 cfs at full gate. The design capacity of each turbine is 200,000 hp at best efficiency, at a 300-ft head. The generators deliver 167,000 kva or 150,000 kw at 0.90 power factor, which puts them among the largest units ever built.

The powerhouse is a modified outdoor type; elimination of the conventional superstructure afforded substantial economy. The structure is 1,850 ft long, 389 ft high above the foundation, and 580 ft in width. A traveling crane of 630-ton capacity will service the units. It carries a heated housing sufficiently large to completely enclose a unit for minor service or for transport to the service building. The turbines discharge into the Niagara River just upstream from the existing Sir Adam Beck Power Plant on the Canadian side of the river.

Because of the large amount of power, which must be transported a very considerable distance for use, transformers in the plant take the 13,800-v output of the generators and step it up to 115 or 230 kv. At the nearby switchyard it can be stepped up further to 345 kv for distant transmission.

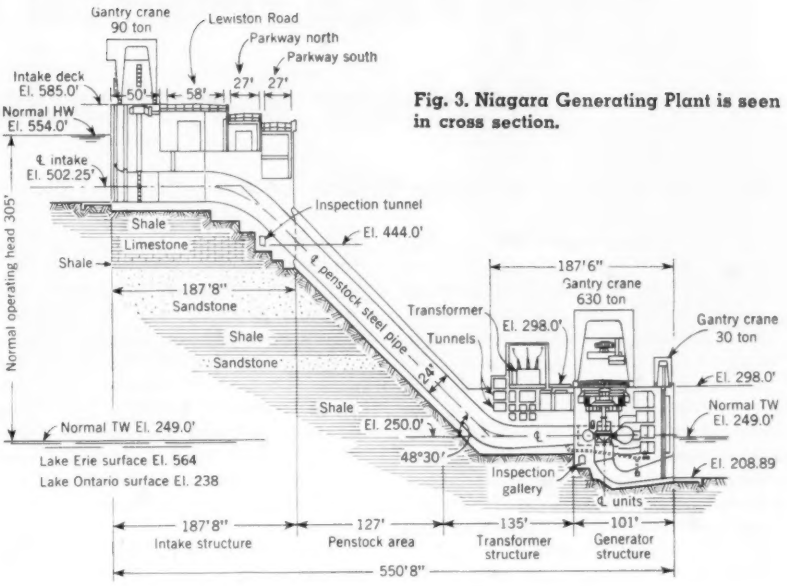


Fig. 3. Niagara Generating Plant is seen in cross section.

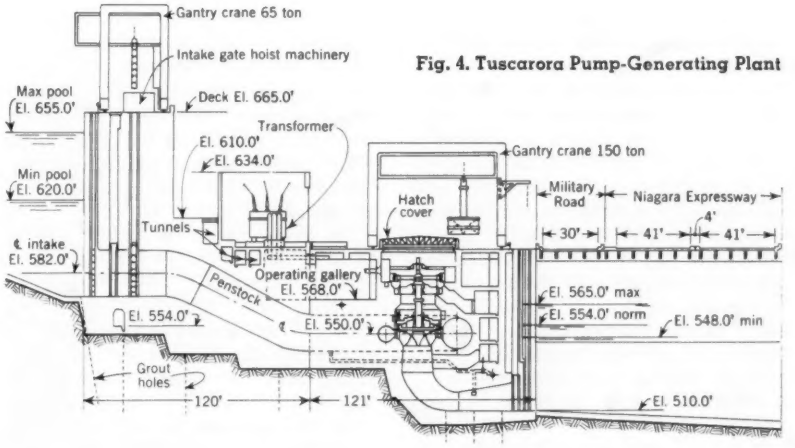


Fig. 4. Tuscarora Pump-Generating Plant

Reservoir pump-generating plant

A dual-purpose pump-generating plant will take the extra water available during nighttime flow and lift it as much as 100 ft for storage to meet the maximum power demands of daylight hours. Twelve pump-generator units are installed in a structure 974 ft long, 160 ft high, and having a width of 240 ft. The units are of the fixed-blade, non-feathering Francis type and have runners of 206-in. diameter, the largest that could be shipped in one piece. Each generator is capable of pumping 3,400 cfs at a net head of 85 ft and of producing 20,000 to 28,000 kw of power as the water flows back through the units. The same water then passes through the turbines of the main plant, augmenting the allocated natural flow during daylight hours.

The two generating plants will have an installed capacity of 2,190,000 kw, compared with 1,974,000 kw at Grand Coulee Dam and 1,824,000 kw at the St. Lawrence Project jointly operated by the New York State Power Authority and Ontario Hydro. The annual energy output is expected to be 13 billion kwhr.

An important element in the Niagara Project is the high-tension tie-line between the Niagara and St. Lawrence plants. The Authority is constructing two 345,000-v circuits between the new plant and Rochester and one 345,000-v circuit from Rochester to Utica, where a connection is made to the St. Lawrence plant by two existing 230,000-v lines. The tie-line increases the firm power capacity of each project, because normally water flow at the St. Lawrence Project is highest during the summer, the season during which the U.S.-Canadian treaty reduces the available water for power production at Niagara Falls.

The scars of construction are now rapidly disappearing at the Niagara plant as covering of the conduits is completed. The area traversed by the conduits was criss-crossed with streets, railroads and electrical transmission lines, all of which had to be maintained while an open cut as much as 150 ft deep was made. Subsurface utilities included not only the usual water, sewer and gas lines but also hydrogen, acetylene, chlorine and other chemical lines between industrial plants. Some 19 transmission lines and 100 homes had to be moved. The entire area is now being restored for industrial, residential and recreational use.

The incidental program in connection with the project, participated in by other agencies, includes the Niagara Parkway, the Niagara Expressway, a new bridge between Lewiston, N.Y., and Queenston, Ontario, and the long-awaited railroad grade-crossing eliminations. May 30, 1962, will mark the opening of the new international bridge and the expressway approach to it. One section of the Niagara Parkway was opened to traffic last summer. Other sections will receive traffic as they are completed. The year 1963 should see substantial completion of the entire integrated program at Niagara.

Two ASCE Technical Divisions Sponsor May Conferences

Air Transport Conference—Miami Beach—May 8-12

Today's spectacular developments crowding each other in the field of air transport guarantee the significance of the Air Transport Division Conference. The program for this year's conference—planned in cooperation with the Airport Operators Council—will feature the planning, design, and operation of airports. Topics will include trends in aircraft design as they affect airport design, supersonic transports, airport capacity studies, lighting, air traffic control, arresting gear for civil operations, and many others. Sessions will be held at the Carillon Hotel, Miami Beach, May 8 through 12.

The Airport Operators Council, which represents the management of the nation's largest airports, will begin its meeting on May 8. The AOC program will concentrate on management and policy aspects of airports in contrast with the Air Transport Division program, which will be concerned with technical considerations. ASCE members are cordially invited to attend any of the AOC open sessions, which will give them a chance to discuss problems of mutual interest with airport operators, aircraft manufacturers, and other organizations concerned with airport development.

Air Transport Division sessions will occupy Thursday and Friday, May 11 and 12. The opening program, on Thursday morning, will focus on airport needs of the future, with attention to operating capacities and economic considerations. Speakers will include George DeMent, commissioner, Bureau of Engineering, Chicago Department of Public Works; Martin A. Warskow, consultant, Aviation Systems Research Department, Airborne Instruments Laboratory, Long Island; Paul A. Stafford, Porter and O'Brien, Newark, N. J.; and Prof. Robert Horonjeff, University of California, Berkeley.

Different aspects of airport and terminal planning will be discussed Thursday afternoon in three papers. Authors are Ray O. Kusche, president, Quinton Engineers, Los Angeles, Thomas M. Sullivan, first deputy director, Aviation Department, Port of New York Authority; and Walter N. Pike, chief, Data Processing and Display Branch, Federal Aviation Agency.

Friday morning papers will be concerned with aircraft design as it affects runway length and other factors; supersonic transports; and vehicular traffic control at airports. Featured speakers are Weldon E. Rhoades and Ralph Glasson, United Air Lines, Inc., San Francisco; Reginald Sutherland, director, facilities engineering, American Air Lines, Inc., New York City; and I. Gilboa, traffic engineer, DeLeuw, Cather and Company, San Francisco.

A wide range of topics will be studied in the Friday afternoon program. Thurman D. Weir, Wright Air Development Division, U.S. Air Force, will discuss "Application of Arresting Gear for Civil Aviation"; Prof. Dan M. Finch, University of California, Berkeley, will describe new developments in airport lighting; and Frank Mellinger, director, Ohio River Division Laboratories, Corps of Engineers, Cincinnati, will summarize design and construction practices for prestressed concrete pavements.

Prof. Robert Horonjeff is general chairman of the technical sessions program for the Air Transport Division Conference. He may be addressed at the University of California Institute of Transportation and Traffic Engineering, 1301 S. 46th Street, Richmond, Calif.

Engineering Mechanics Conference—Troy, May 18-19

A wide range of applications in the applied mechanics field will be discussed in papers scheduled for presentation at the Engineering Mechanics Division Conference. Subjects include the response of multi-story structures to earthquakes, wind stresses in domes, elastic and photo analysis, and experimental analysis. The conference will be held at Rensselaer Polytechnic Institute, Troy, N.Y., May 18-19, with the Mohawk-Hudson Section and Rensselaer Polytechnic Institute as cosponsors. Technical sessions and registration (all day on Thursday and until noon on Friday) will be held in the Troy Building. Authors Breakfasts both mornings and the conference banquet, on Thursday evening, May 18, will take place at the Hendrick Hudson Hotel. Conference luncheons both days will be held in the college dining hall. Forms for advance registration and hotel reservations will be made available in the forthcoming Engineering Mechanics Division Newsletter. Copies may be obtained by postcard request to ASCE Executive Secretary William H. Wisely, 33 West 39th Street, New York 18, N.Y.

The Thursday morning session, devoted to experimental analysis, will feature papers by Melvin Zaid, Technik Inc., Garden City, N.Y.; Frederick L. Ryder, Republic Aviation Corp.; and Prof. August J. Durelli and Cesar A. Sciammarella, Illinois Institute of Technology. Greetings from the host, Rensselaer Polytechnic Institute, will be conveyed to the group by Clayton O. Dohrenwend, provost and professor of mechanics.

Speakers on the Thursday afternoon overall topic, "Elastic and Plastic Analysis," will be Oscar DePineros, assistant professor of civil engineering, Ohio Northern University, Ada; Joseph Marin, professor and head of the department of engineering mechanics, Pennsylvania State University, University Park; Professors Robert L. Schiffman and Bhagwan D. Aggarwala, Rensselaer Polytechnic Institute; Mrs. Annabel L. Tong, Stearns and Wheler, Cazenovia, N.Y.; and Prof. John E. Goldberg, Purdue University, Lafayette, Ind.

The Friday morning program will consist of papers in the dynamic analysis field. Authors are Prof. Robert K. Wen, Michigan State University, East Lansing, Mich.; David Burgreen, consulting engineer, Nuclear Development Corporation of America, White Plains, N.Y.; Prof. Ming L. Pei, City College of New York, New York; and Prof. Glen V. Berg, University of Michigan, Ann Arbor, Mich.

Authors scheduled to present various aspects of the subject, "Shells, Domes and Plates," on Friday afternoon are: Prof. Iradj G. Tadjbakhsh, Rensselaer Polytechnic Institute; P. Gondikas, consulting engineer, Ath-

ens, Greece; Prof. Mario G. Salvadori, Columbia University; and Prof. E. Turan Onat, Brown University.

At the conference banquet, highlight of the social program, William H. Hoppmann II, professor of mechanics at Rensselaer, will speak on the Dead Sea Scrolls. Merit P. White is Division chairman of the Committee on Programs, and Martin R. Brown, Jr., is general chairman of the program committee representing the Mohawk-Hudson Section and Rensselaer Polytechnic Institute.

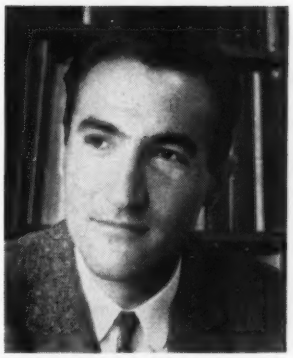
ASCE Research Prizes to Be Presented at Phoenix

Presentation of the ASCE Research Prizes for 1961 will be a feature of the Awards Luncheon held during the Phoenix Convention. President Holcomb will present the awards to Ray W. Clough, Phil M. Ferguson, Donald R. F. Harleman, Bruno Thurlimann, and David K. Todd. Each award consists of $100 and a suitable certificate. The Research Prizes were established in 1946 to stimulate research in civil engineering. Brief biographies of the 1961 recipients follow:

Ray W. Clough, Jr., professor of civil engineering and vice chairman of the Division of Structural Engineering and Structural Mechanics at the University of California, Berkeley, has been in the Civil Engineering Department since 1949 and has had the rank of professor since 1959. In 1956-1957 Dr. Clough studied ship vibrations at the Norwegian Institute of Technology under a Fulbright Research Fellowship. Dr. Clough's publications relating to earthquake response of tall buildings, inelastic behavior of columns due to dynamic loading, and effects of earthquakes on rock-fill dams have received wide recognition. He has been chosen to receive the 1961 Research Award "in recognition of his outstanding contribution to knowledge of the dynamic behavior of complex structures."

Phil M. Ferguson, professor of civil engineering at the University of Texas, teaches in the field of structures, particularly in reinforced concrete and frame analysis. He has been in the Department of Civil Engineering since 1928, and was department chairman from 1943 to 1957. Professor Ferguson is chairman of the ASCE Structural Division Committee on Masonry and Reinforced Concrete and past president of the American Concrete Institute. His researches have contributed materially to knowledge and understanding of ultimate strength design concepts. He was cited "in recognition of his outstanding contribution to knowledge of the behavior of concrete structures."

Donald R. F. Harleman, associate professor of hydraulics at Massachusetts Institute of Technology, has been at M.I.T. since 1946, when he joined the staff of the Department of Civil and Sanitary Engineering as a research assistant. After receiving the master of science degree in 1947, he continued as a research associate and was awarded the doctor of science degree in 1950. Dr. Harleman has made significant contributions to knowledge of density currents, turbulent diffusion, and mixing accompanying subsurface flows, the hydraulic analogy of shock wave phenomena in supersonic flow, and wave forces on submerged objects. He was cited for "his outstanding contribution to knowledge in the field of hydraulics."



David K. Todd

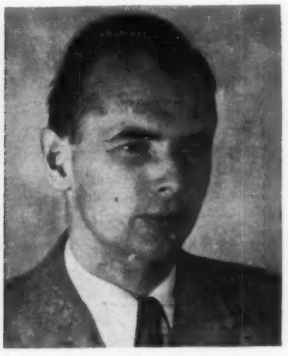
Bruno Thurlimann, professor of structural engineering, Swiss Federal Institute of Technology, Zurich, Switzerland, graduated from the Institute in 1946. He did graduate work at Lehigh University, receiving his doctorate in civil engineering in 1951. In 1952 he was research associate in mathematics at Brown University, and from 1953 to 1958 he was on the civil engineering staff of Lehigh University. He has been at the Swiss Federal Institute since 1959. He is cited for "his outstanding contribution to the development of plastic design concepts."

David K. Todd, associate professor of civil engineering, University of California, Berkeley, has been on the civil engineering staff there since 1950. Since 1956 he has also served as consultant to the California Department of Water Resources. A graduate of Purdue University with graduate degrees from New York University and the University of California, Dr. Todd spent 1957-1958 in Europe as a National Science Foundation post-doctoral fellow. He is author of some fifty publications and a textbook on ground-water hydrology. Dr. Todd was cited for "his outstanding contribution to knowledge in the field of ground-water hydrology."

Ray W. Clough

Phil M. Ferguson

Donald R. F. Harleman



Bruno Thurlimann

Planning for Hydraulics Division Conference

Success of the Tenth Annual Hydraulics Division Conference, to be held at the University of Illinois in Urbana, August 16-18, is the aim of this get-together of Central Illinois Section members. Seated, in usual order, are Prof. Ven Te Chow, Co-Chairmen William C. Ackermann and Prof. Wallace M. Lansford, and Committee Member William D. Mitchell. Other committee members (standing, left to right) are Prof. James M. Robertson, Prof. Marlyn E. Clark, Harold W. Humphreys, Wyndham J. Roberts, Prof. Murray B. McPherson, John B. Stall, and Prof. John C. Guillou.

ASCE Active in Upgrading Surveying and Mapping

The Committee on Professional Practice, the Surveying and Mapping Division and Executive Secretary William H. Wisely of ASCE are actively pushing the upgrading of Surveying and Mapping to full professional status.

Late in February Mr. Wisely, with Earle J. Fennell, F. ASCE, a member of the Executive Committee of the Surveying and Mapping Division, and A. O. Quinn, F. ASCE, representing the Association of Professional Photogrammetrists, held conferences in Washington with top personnel of the Corps of Engineers and of the Bureau of Reclamation. These conferences with the chief government users of surveying and mapping services were very productive in achieving a better understanding of the problem. For many years most such contracts have been let on a competitive basis, and considerable readjustment is proving necessary in widely scattered field offices.

In conferences with the government agencies a great need for impartial and authoritative curves or schedules of prevailing fees in field surveying and in photogrammetry was apparent. A pamphlet that would serve the purpose of Manual of Practice No. 38 but pertaining specifically to the surveying and mapping field would be very useful.

At a recent meeting of the Committee on Professional Conduct it was concluded that specialists in the field would have to provide guidance for clients in knowing when to negotiate and when it would be permissible to use competitive bidding methods. The Committee on Professional Conduct recommended that the Task Subcommittee on Professional Practice in Surveying and Mapping be reactivated in the Committee on Professional Practice to provide such guidance. Mr. Wisely urged that the Division instruct its representatives in the subcommittee to apply themselves immediately to the production of a manual which would include prevailing fee data and guidance as to the delineation between professional and non-professional services.

Letters have been sent by ASCE to all known users of contract surveying, mapping and photogrammetric services urging negotiation for all work involving engineering judgment. These include highway and public works agencies; the Corps of Engineers, U.S. Army; the Department of the Interior; and others. Response has been favorable from federal and state agencies despite the serious problems of transition from competitive bidding to negotiation.

As requests for bids where price appears to be a factor come to the attention of ASCE, Executive Secretary Wisely writes a letter to the contracting agency urging that they change to negotiation procedures. More than thirty such letters have gone out in the past few months. Most reputable firms in this field are refusing to bid competitively, which is a real factor in the success of the drive to upgrade the profession.

Australian Overseas Unit of ASCE Is Activated

Activities of the recently formed Australian Overseas Unit of ASCE (December 1960 issue, page 77) are in full swing. Its second meeting, held in February, featured a talk on "Management Problems in the Building Industry," by Peter Dirkis, M. ASCE, Canberra City, Australia. His talk inspired a long impromptu discussion of investment principles, tendering and contracting, promotional work, finance, industrial expansion, and related problems. The Unit has launched a fund drive for contributions to the United Engineering Center, directed to ASCE members residing in Australia and New Zealand.

ASCE Overseas Units are organized to provide a means for professional association among resident or transient members outside the United States. Members traveling in an area served by an Overseas Unit are invited to contact the secretary concerning its activities. Secretary of the Australian Overseas Unit is J. A. Saftich, P.O. Box 17, Milsow's Point, N.S.W., Australia.

Papers from Engineering Education Conference

The challenging papers coming out of the Civil Engineering Education Conference, held in Ann Arbor, Mich., last July, are now available in a volume entitled *Civil Engineering Education*. This publication (ASCE 1961-6) will provide the nucleus for deeper study of one of today's most vital topics. It is the culmination of the joint efforts of The Cooper Union, the American Society for Engineering Education, and ASCE, working with a grant from the National Science Foundation.

The Ann Arbor Conference studied the future scope and content of civil engineering curricula, with the aim of revising curricula so as to reverse the trend of decreasing enrollments and

attract better qualified students into the field. As noted in CIVIL ENGINEERING (August 1960, p. 106, and January 1961, p. 56), Conference delegates will vote on the various resolutions by letter ballot after they receive copies of this publication. The results of the balloting will be announced in CIVIL ENGINEERING as soon as they are known.

To facilitate ordering a copy of *Civil Engineering Education*, a coupon has been provided on page 115.

Congress on Large Dams To Be Held in Rome

The Seventh International Congress on Large Dams of the World Power Conference will be held in Rome, June 26-July 1, followed by study tours ending July 9. The Congress is being organized by the Italian National Committee on Large Dams, under the sponsorship of the Italian Ministry of Public Works.

A number of questions in the field of dams will be discussed and answered in the technical sessions. These prepared questions will develop information in such areas as the selection, processing, and specification of aggregates for concrete for large dams; underground work in connection with large dams; modern concrete dam techniques for wide valleys and ancillary works; and sealing of earth and rockfill dams with bitumen and other material.

A choice of four study tours will be available at the close of the technical program. The tours will offer visits to a wide variety of dams in Italy and Sicily, thermo-electric power stations, and allied projects in the power field. In addition, they will afford a number of sightseeing opportunities, plus special programs for the ladies of the party.

Engineers planning to attend the Seventh Congress should return registration forms at once (by airmail) to the Comitato Italiano Grandi Dighe, Ministero dei Lavori Pubblici, Rome, Italy. Forms may be obtained from the U.S. National Committee on Large Dams, World Power Conference, 29 West 39th Street, New York 18, N.Y. Thomas Cook is official travel agent for the Congress.

The International Commission on Large Dams was established in 1928 with a view to promoting and coordinating technical research in the field of dams. The Sixth Congress on Large Dams was held in New York in 1958, followed by study tours of U.S. dams and hydroelectric installations.

Symposium on Penstocks

Issuance of the fourth publication in the Proceedings Symposium Series is announced. The discussions and closures for these papers on penstocks—reprinted from the Journal of the Power Division—have been collated and the entire group is now presented under one cover.

Both general and specific phases of penstock design and construction are discussed. Designers and constructors have related their experiences in the field in dealing with the common problems and recent developments involved. In addition, a number of prominent builders of penstocks describe their own penstock practices.

The list price for the paper-bound volume is $4.00, with the usual 50 percent discount available to ASCE members and to public and school libraries. A coupon to facilitate ordering will be found on Page 127.

City Planners, Engineers And Attorneys—A Team

A recent meeting of the Municipal Law Section of the New York State Bar Association heard Earl F. O'Brien, ASCE Director, of Syracuse, N.Y., tell about the engineers' part in planning and zoning. Conceiving, planning, and execution of physical planning programs do require the services of people trained in the disciplines of engineering and architecture.

The most important engineering services are those performed before designing begins, Mr. O'Brien said. An engineer exercises his highest degree of skill and utilizes his most mature judgment when he gives advice on the formulation of a program. He may very possibly render best this service when he advises that nothing be done.

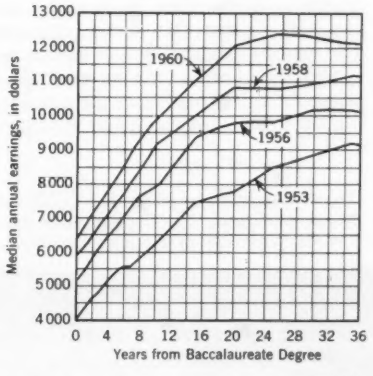
A paper prepared for the same meeting brought out limitation on the sphere of the engineer in city planning and zoning. R. B. Allen, general counsel of the Illinois State Bar Association, said that this organization had investigated cases in which city planners had prepared ordinances and given legal advice regarding their application and interpretation. The Illinois Bar group felt this to be an unauthorized practice of law. The municipal attorney, city planner, and the engineer should form a team whose services will enable municipalities to meet the needs of growing urbanization in the United States, Mr. Allen stated.

Engineers' Salaries Continue to Rise

A survey of nearly 200,000 engineers throughout the country indicates that engineers' salary levels rose approximately 5 percent per year between 1958 and 1960. In a study, entitled "Professional Income of Engineers-1960," the Engineering Manpower Commission of Engineers Joint Council reports that the median annual salary for those surveyed now stands at $9,600 with the median age at about 32.

The recent increase of about 5 percent may be compared with an average annual increase of 6½ percent between the first survey in 1953 and the last one in 1958. The overall median was $6,500 in 1953, $7,750 in 1956, and $8,750 in 1958. Total increase in survey median over the seven-year period has been 49 percent. This may be compared with an increase of 10 percent in consumer price index and one of 27 percent in the average weekly wages of production workers over this period.

A marked difference exists between engineering salaries in industry, government and education, with the highest level in industry, followed by education and government. The report by EMC contains data on engineers' salaries in 22 subdivisions of industry (including construction and consulting services) with separate curves for various educational levels. Also included are engineering salaries in all levels of government, as well as in colleges, technical institutes and engineering societies. In fact, the report covers about a quarter of the estimated engineering force in the United States.



Copies of the report are available from the Engineering Manpower Commission of Engineers Joint Council, 29 West 39th St., New York 18, N.Y., at $3.00 a copy-slightly lower in bulk.

(*More ASCE News on Page 69*)

Civil engineering trends in Europe today

F. CHARLES GREENFIELD, M. ASCE, Handforth, England

As winner of the Culmann Traveling Fellowship, 1958-1959, offered by England's Institution of Civil Engineers, Mr. Greenfield spent a year in Europe studying design and construction in concrete and steel. A paper giving his observations in this interesting field was printed in the *Proceedings* of the Institution (Vol. 16, pp. N11-N23, July 1960) and forms the basis for this condensation. American engineers will be interested in an Englishman's views on Continental European practice.

With every European country moving towards the American standard of living it would seem that many mechanization trends in civil engineering will follow lines similar to those in the United States. Since Europe is not so rich in steel as is America, it is likely that precast concrete, in spite of its limitations, will one day become the dominant structural material.

Developments in structural steelwork, often in keen competition with precast concrete, are following similar lines, that is, every possible operation is being done off the site, in the largest possible sections, and in the shortest possible time. Clearly, the automatic welding machine will replace the welder and the riveter wherever practicable.

The progress that will inevitably occur in factory techniques—improving output and lowering costs—must be weighed against the performance of the man on the site, which cannot be expected to keep pace with the rise in wages he will expect from the new era. Further, the quality of the factory product is already of such a high standard everywhere in Europe that the demand for individual workmanship, characteristic of former times, is greatly reduced.

Transportation

The tremendous construction programs in Europe today are activated by an unprecedented rise in living standards for all. Widespread car ownership accounts for many of the civil engineer's problems. Many countries are viewing their transportation systems as a whole. Thus, in conjunction with the new urban road system of Berlin, considerable extensions are being made to the underground railway. In Milan, too, the construction of an underground railway is being provided as one of the best means of solving street traffic problems.

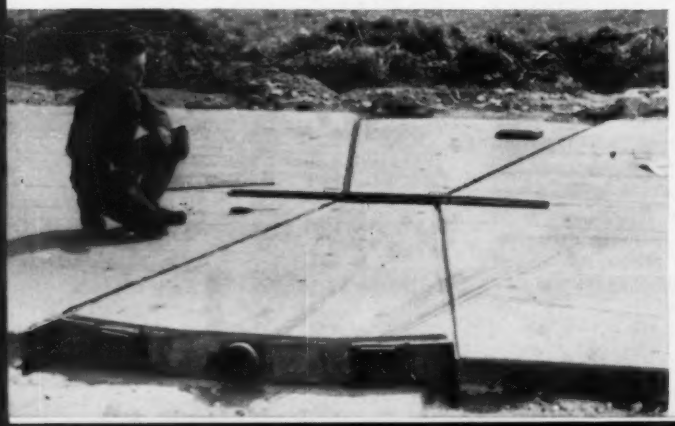
The treatment of internal transport as a single national problem is nowhere more evident than in the Low Countries, where the bold outlook appears to stem from the densest population in the world combined with a position as the gateway to Europe. Holland's new electric railway system is probably the finest in Europe. Belgium has a 10-year plan, providing for the complete modernization of roads, canals, and railways.

Postwar bridge construction

Faced with a gigantic postwar bridge-building program, to be carried out in the shortest possible time and with the minimum of every commodity, German engineers have performed miracles. New techniques had to be evolved which often required considerably more effort in design calculations. The Severin Bridge, Cologne, is an example of success in this task. The widespread application of automatic welding, three-dimensional cables, low-alloy steels, high-strength bolted joints, box girders in place of plate girders, and orthotropic plate design for the decks, reduced the weight of steel required to about half that considered necessary a quarter of a century earlier. Prefabrication of entire sections reduced the time factor. The use of one tower only pleased harbor authorities, preserved the view downstream, and provided a counterpoint to the great cathedral. River traffic was not seriously impeded, since construction was performed on the cantilever principle and temporary river supports were kept to a minimum.

The cantilever principle has also been applied to the construction of prestressed concrete bridges. In the German *Dywidag* system, both the concrete and the forms are cantilevered. The elimination of conventional centering makes the method particularly economical for viaducts over deep ravines. For construction over important rivers, such as the Rhine, the extra cost (if any) is well repaid, since there is little inconvenience to navigation. The completed bridges over the Rhine at Worms, and the Mo-

The Swiss have used wedge prestressing successfully on experimental road. The French used an inflated jack with good results. Courtesy of B.B.R.V., Zurich.



At Ludwigshafen, Germany, single columns support a roadway 95 ft wide. The structure shows what can be done with bare concrete. Courtesy Dyckerhoff & Widmann, K.G., Munich.

This railroad bridge at La Voulte-sur-Rhone was constructed by cantilevering the concrete in conjunction with prestressed struts, the sliding forms being supported on temporary steel girders. Courtesy S.N.C.F. and Enterprises Boussiren.

selle at Koblenz, are well proportioned, unostentatious, and blend well with the landscape.

The same method is being employed at present in the Nordbogen Bridge, Berlin, the Mangfall Viaduct, near Munich (this time with prestressed concrete lattice girders), and also in Scandinavia. The French and the Swiss, employing the B.B.R.V. system of prestressed concrete, have also been extremely successful in the railway viaduct at La Voulte-sur-Rhône, shown in an accompanying photograph. Here only the newly placed concrete was cantilevered (in conjunction with temporary prestressed-concrete struts), the sliding forms being supported by temporary steel girders. In many cases where, until recently, steel was the automatic choice, the use of cantilevering with prestressed concrete now provides strong competition for spans up to at least 400 ft.

The 5-mile Maracaibo Viaduct in Venezuela probably represents, for sheer size at least, the peak in concrete bridge construction to date, and is perhaps the most notable example of the infiltration of concrete into fields previously the prerogative of steel. Under construction at present by the German firm of Julius Berger, A.G., to the designs of Professor Morandi of Rome, the colossal 760-ft center spans, with towers rising 320 ft above water level, will provide bridge engineers with something to think about for years to come. Everything possible is precast.

In general it may be said that for road bridges in Europe today, prestressed concrete is now the outstanding material. For small one- or two-span bridges, pretensioned beams up to about 85 ft are becoming increasingly popular, although as yet Germany seems to be the great exception. For spans up to about 400 ft, post-tensioned concrete bridges and approaches (usually with continuous beams and two-way prestressed decks) can be seen with almost monotonous regularity. For long-span bridges, even though steel may still be the answer, prestressed concrete now plays a large part in the approach spans and is sometimes used for the deck slabs of suspension bridges. A particularly good example is the Rodenkirchen Bridge at Cologne.

So far steel is the dominant material for railway bridges, and some particularly interesting welded designs have recently been utilized in Germany. There are also a number of recent examples to be found in concrete, including a three-span spandrel arch bridge and a skew double-box-culvert type for the new Ghent Ringvaart. However, none seems to be quite so spectacular as the earlier Voulte-sur-Rhône Viaduct (seen in an accompanying photograph), which is famous for its beautifully clean-cut lines.

An interesting new development in Belgium is the prestressed suspension bridge, a design also to be used for the new Ghent Ringvaart. The principle involves jacking the towers after laying the cables and the concrete deck to provide a predetermined load on the cables, the tension being measured as the jacking proceeds. In effect, the bridge is a large continuous prestressed concrete beam with a wholly external tendon. So far the maximum span employed is only 330 ft, but in considering the feasibility of much longer spans the inconvenience of falsework should be borne in mind. It should also be remembered that the Ghent bridges possess the rather unique advantage that the canal for which they were intended had not yet been excavated when they were built.

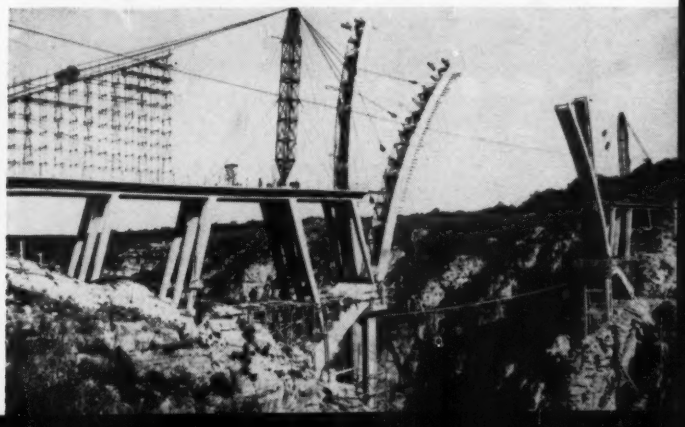
The new Tancarville suspension bridge at Le Havre possesses a number of interesting features. No doubt with future maintenance in mind, the towers were built of concrete. The thrust on the approach viaduct side is taken by a huge hinged concrete abutment, the other side being anchored into the mountain.

Reinforced-rubber abutment bearing pads are everywhere gaining popularity. In comparison with steel details they are, of course, simple and cheap and are often substituted for hinge and rocker.

Joints of polyester glue have been used on a small steel bridge at Marl-Hüls, Germany, built about 5 years ago. Perhaps not possessing quite the same faith as the manufacturers, the authorities insisted on the provision of bolts also, placed in over-size holes, so

The Alwegbahn monorail in Germany may play a major role in solving city traffic problems. A monorail at Wuppertal has been in trouble-free operation for 60 years.

In north Italy segments of a concrete arch, designed by Prof. Riccardo Morandi, were cast vertically and then lowered into position.



Mountainside culverts in Switzerland are built using deflatable duct-tubes.

that failure of the glue would reveal itself by undue deflection of the bridge. So far the glue has stood the test. Experimental concrete beams have also been glued successfully by the same manufacturers.

High dams for power

Construction of dams at considerable altitudes in remote regions, such as the Grande Dixence and the Mauvoisin in Switzerland and the Vaiont in Italy, present the civil engineer with innumerable problems, and also test his skill, courage, and imagination to the utmost. The three dams just mentioned approach the Eiffel Tower in height and their construction involves considerable risk to all concerned. Grande Dixence involves the placing of 8,000,000 cu yd of concrete.

Recent continental developments in dam design seem to have been concerned more with cellular construction, the pure arch, and the gravity arch. Apart from Scotland's Allt-na-Lairige Dam, the few examples of prestressed concrete dams in Europe seem to be prestressed only within the structure itself. Thus the prestressing is concerned only with the reduction of horizontal tensile stresses in the arch, rather than with the balancing of overturning moments, such as would be provided by vertical prestressing anchorage tendons.

In several countries the trend is to build a hydro power-station actually within the mountain. Surprisingly, this does not seem to involve appreciable extra cost. Advantages appear to be mainly camouflage and protection from bombing and missiles, and also the saving of valuable space in the valleys. The Germans and Swiss sometimes build the power station served by a particular dam actually inside the next dam further downstream.

For the construction of mountainside "feeder" culverts to their impounding reservoirs, the Swiss often employ rubber duct tubes, which are bedded on and surrounded by concrete. After the concrete has set, the duct tube is deflated and used again. The culvert so formed can negotiate bends quite impossible for conventional pipes, which in many cases could not be transported and handled in such difficult terrain. Although the duct tube is expensive, the resulting culvert is of course much cheaper than a tunnel through the rock. Originating in France, duct tubes are now used extensively on the Continent for storm drains, electrical ducts, and many other purposes.

Already used for a variety of works varying from small-house extensions to huge power stations, the Menard pressure meter (from Paris) is an ingenious tool for determining soil strengths at depths up to about 200 ft. The apparatus is remarkably simple. A borehole about 2½ in. in diameter is augered to the required depth and a rubber cylinder lowered into it. Measured water and air pressure are applied to the different compartments of the cylinder (the water in the center, with air above and below) and the resistance of the ground is related to the pressure applied. It is understood that this pressure meter functions in any type of soil, regardless of the level of the water table.

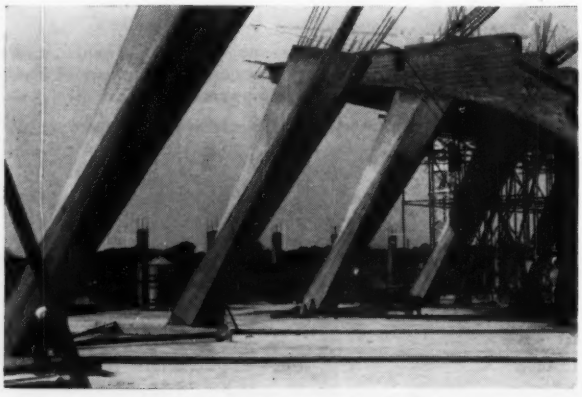
Multipurpose structures

When building elevated engineering works, it is now a popular Continental practice to provide a secondary function for the benefit and amusement of the general public. This usually takes the form of a restaurant and lookout platforms. In many cases the tourist attraction is considerable and the structure pays for itself within a few years. A television tower at Dortmund, Germany, is set in the midst of a beautiful recreational park, which contrasts vividly with the industrial town. It is typical of the Teutonic mind that the restaurant is arranged to revolve (from 2 to 6 rph) so that everyone can have a fair share of the sun and a view of the landscape over 400 ft below. Water towers frequently have high-level restaurants built into them.

On the construction side, the latest practice in Scandinavia is to build the tank of a water tower at ground level, and subsequently jack it up to the required height. Sometimes only the floor and "starter" wall are built in this manner, the wall proper and the roof being constructed in final position. A 300-ft television lookout tower overlooking Rotterdam Harbor was built with slip-forms, and the steel restaurant was hoisted up afterwards.

The engineer and esthetics

On the Continent today there are many fine examples of engineering expressed in concrete and steel; there are also many beautiful examples of



The Palazzo dello Sport in Rome is a creation of Pier Luigi Nervi. It seats 16,500. Detail is at the lower balcony.

modern architecture (perhaps mainly inside work). But it is the writer's opinion that, with some truly notable exceptions, there are few buildings in which the two are found together, each doing full justice to the other. But can such a standard be obtained if economy is not to be forgotten? It is the writer's belief that it can.

The exposure of plain unadulterated concrete, both externally and internally, has now become quite commonplace on the Continent and, in a number of instances when applied in suitable proportions, the results have been remarkably successful. In some cases the boldness of its intrusion are quite staggering—foyers and boxes in lavish opera houses, roof beams and columns in magnificent congress halls. It provides unlimited scope for the architect's imagination; it delights the engineer to see his work at last revealed to all; and it is very inexpensive to the client. But of course boldness has sometimes been carried to extremes, and the results can easily amount to austerity, and after a certain lapse of time, to a depressing shabbiness.

In his use of exposed concrete, both in situ and precast, as an engineering-architectural material, Pier Luigi Nervi, in Italy, must surely be considered outstanding. Such creative and imaginative work, revealing the hand of the craftsman combined with the very best that mass production can offer, has provided a new concept in building construction and has proudly taken its place beside the architectural treasures of the past. The Palazzo dello Sport, which seats 16,500 people, cost $980,000 excluding fittings, and the Palazzetto dello Sport cost only $420,000 complete. See accompanying photographs.

Such works of art are the creation of an engineer-architect working with engineering-architectural material and assisted by a staff of engineers and architects. Since the best in both fields are so rarely found together today, a lesson can be learned from these buildings. Certainly there has never been a greater need for the architect and the engineer to work in harmony than there is today.

Engineering and contracting

It is well known that engineers in the United Kingdom conduct their profession very differently from their Continental confreres. Throughout Western Europe and Scandinavia basic practice does not seem to vary greatly between countries. It can only be assumed that the island position of Britain accounts for its unique system. The writer would not presume to judge the relative merits of the two systems, but it may be worth while to consider some of the main characteristics of Continental practice.

The smaller Palazzetto dello Sport in Rome, also by Pier Luigi Nervi, with Annibale Vitellozzi as architect, has an unusual arrangement of supporting arches.

On the Continent it is common practice for a client to invite tenders for design and construction. This enables him to consider many alternatives before committing himself to a considerable expenditure. It may often happen that at least one design contains a revolutionary principle which is particularly suitable for the contractor's resources, saves considerable expense, shortens construction time, involves negligible maintenance cost, and looks very much more attractive than an alternative conventional method. Such designs as the German and French cantilevered bridge construction, the new Palais des Expositions, Paris, and the "poems in concrete" of Pier Luigi Nervi, are examples of the very best Continental practice.

It is impossible to remain unimpressed by the closeness of the ties that exist on the Continent between the university and industry. Indeed, it is a mystery how so many engineers find time to combine their duties at a university with their engineering practice. Invitations for a vacant chair are often extended to an eminent practicing engineer who need not suffer financially since he will have full opportunity to act in a private capacity. Under this system the experience of the finest engineers is made available not just to a few privileged assistants, but to thousands of prospective engineers (the new lecture theater at the Aachen Technische Hochschule seats 1,200 students), who are taught to view theory and practice in true perspective.

Conversely nowhere in Europe is there less appreciation of the civil engineer's work than in the United Kingdom. Indeed, Britain has reached a stage when the term "engineer" is quite meaningless, whereas in Italy an engineer is addressed by this title and is held in the highest respect by the general public. Nowhere else in Europe is there confusion in the layman's mind as to the distinction between a professional engineer and a technician or tradesman.

Conclusions

Many Continental engineers—to the delight of their architectural associates—now design their building columns purely for vertical loads, in order to reduce column sizes. Wind loading is taken by elevator shafts, stair wells and end walls via the floors. But today, as always, the bridge remains the best structure for expressing the art of civil engineering. Perhaps no type of construction can do so more successfully than the suspension bridge, but the properties of prestressed concrete have provided the Europe of today with very many fine bridges unrivaled in the past in slenderness of proportions and simplicity of outline. It seems evident that the student in search of engineering combined to perfection with modern architecture would do better today to look at the bridges rather than the buildings of Europe.

It is of interest to note that no matter how small its area or meager its natural resources, each of the countries referred to has expressed itself most brilliantly in at least one aspect of civil engineering. Particular fields of progress have often been dictated by differing national needs and natural resources, and one country can well learn from another in the light of such variations.

Many of the colossal schemes now under construction on the Continent may never pay for themselves. The magnificent new Dutch railways, the Delta works, the Zuiderzee works, the complete modernization of the Belgian canals, the Grande Canal d'Alsace, the Grande Dixence Dam of Switzerland will take years to build and will cost a fortune—yet there is a magnificent attitude of pride in them shared by engineer and layman alike. This goes to prove that the wealth of a country lies in its people rather than its resources.

In the March issue Mr. Jarvis discussed the liability of the engineer or architect to the owner for defects in plans or specifications or for negligent supervision of construction. He here continues with a discussion of liability to third parties for personal injury and concludes with some miscellaneous observations on liability. It is suggested that Part 1 be read first. The two articles were originally presented as a paper before a meeting of the American Institute of Consulting Engineers in New York, N. Y.

Part 2. Liability for personal injury

The engineer and architect —as defendant

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The problem of personal injury to third persons not bound by contract to those responsible for the design or prosecution of the work is of interest to all engineers and architects. This is because, since 1916, United States courts have held that the engineer or architect, or both, under certain circumstances may be liable for such injuries.

In 1916, Judge Cardozo, in MacPherson v Buick Motor Co.,[25] referring to suppliers of inherently dangerous chattels (chattels are anything that is owned, with the exception of real estate), ruled that such a supplier is liable to a third party for personal injury even though there is no specific contract between them. This landmark case reversed the thinking of old American cases that held, in conformity with an 1842 English case, Winterbottom v Wright,[26] that no tort action could be brought for breach of a duty existing by virtue of a contract unless the person injured and the defendant were bound by a mutual contract.

Arguing that no distinction should be drawn between a defendant who furnishes a chattel, or piece of equipment, and one who constructs a building, the modern decisions have imposed a similar liability upon contractors whose work or operations caused injury to third persons whether before or after acceptance of the building by the owner.[27]

It has been thought by many in the legal profession that where the engineer or architect is not a warrantor of his plans or of the performance of his duties, he will bear no liability for error or defect in his work product if he has performed his duties with reasonable prudence.[28] Thus when a subcontractor's employee fell through a roof the architect was exonerated because the court found that the roof had been designed in accordance with accepted architectural standards and requirements.[29]

Recently, the current trend of jurisprudence is to put upon the engineer and architect a reasonable duty of care for employees on a construction project because of the foreseeability of injury to them. In a case decided in 1960, known as the Day case,[30] the Louisiana court was confronted with a factual situation where the consultant of the defendant architect failed to provide for the installation of a pressure-relief valve in the hot water system, thereby causing the death of a plumbing subcontractor's employee in the ensuing explosion. As this may develop into a landmark case, a quotation from the court's opinion is in order. As to the architect's duty the Court wrote:

"In view of the circumstances herein shown, we believe a duty existed on the part of the architect to use reasonable care toward the contractor and his employees as well as the various subcontractors and their employees whom the architect had every reason to anticipate would be involved in the construction of this particular project. An architect employed to prepare plans for and supervise construction of a building or facility is not the insurer of the safety of workmen engaged in performance of the work. However, an architect undertaking to render such services with respect to a dangerous instrumentality must exercise reasonable diligence and care under the circumstances to protect against injury to those who may be reasonably foreseen to be imperiled by defective or improper construction or lack of adequate supervision. It is self-evident no criteria may be established by which the duty of reasonable diligence and care may be meas-

ured in every instance. Obviously, such determination must be made in the light of the circumstances of each individual case. In the case at bar the architect was fully aware that part of the mechanical equipment called for by the plans and specifications consisted of a domestic hot-water system containing numerous parts including a boiler which if improperly or negligently installed would become dangerous. The architect was fully cognizant of the fact that employees of the contractor and subcontractor would be called upon to construct, assemble and place in operation a potentially dangerous instrumentality designed and created by their agent, the engineer. An employee of the plumbing subcontractor called upon to install such a mechanism is obviously one whose presence during installation is reasonably to be foreseen and whose injury should be anticipated in the event the normal hazards attending such installation were increased because of the negligence of either the architect or the engineer. It was reasonably foreseeable that a workman called upon to assemble and place the system in operation would be exposed to latent hazards and perils occasioned by faulty or improper design and unseen risks arising from lack of supervision permitting the instrumentality to be placed in operation without full compliance with all safety features provided for by the plans and specifications."

As to the architect's negligence, the Court said:

"Plaintiff further contends both architect and engineer were negligent in failing to adequately and properly supervise installation of the domestic hot water system. In this connection plaintiff points to the testimony of both architect and engineer who stated neither was aware the system was being installed and neither inspected the system during installation or after completion. We agree with learned counsel for plaintiff that such gross laxity, indifference and inattention to an assumed obligation constituted negligence on the part of the architect. The terms and conditions of the architect's contract with the Building Authority clearly imposed upon the architect the obligation of supervising installation of all plumbing and heating facilities. Employment of the engineer as required by the terms of the contract between the architect and the Building Authority did not relieve the architect of the burden of supervision since the nature of the engineer's relationship to the architect was, under the circumstances herein shown, essentially that of an agent to whom had been delegated a duty primarily undertaken by the architect as principal.

"In addition to the negligence of the architect in failing to properly supervise the work (either through his own efforts or those of the consulting engineer), the architect is guilty of further negligence in approving the brochure [shop drawings] despite two prior disapprovals thereof by the consulting engineer. In this connection, we wish to point out the testimony of the architect clearly shows approval of brochures is the duty of the engineer because the architect is not as well informed as the engineer regarding such technical installations. Despite an admitted lack of knowledge regarding such matters, the record establishes it was the architect and not the engineer who approved the brochure pursuant to which Vince made the installation. The negligence of the architect in the respects shown was a proximate cause of the accident rendering the architect liable in damages to plaintiff."

Discussing the architect's defense that as to supervision it was customary in the profession to make only periodic inspection, the Court pointed out:

"The architect maintains failure to supervise installation of such a device was not negligence since it is customary in the professions to make only periodic inspections and according to the usual and ordinary practice of architecture and engineering, no inspection was called for until the system was complete and subcontractor requested final inspection. They further argue that had they inspected the work during installation and directed attention to the fact that the pressure relief valve had not been placed on the boiler, the subcontractor would have explained its absence by replying that he had not yet completed his work and the device would be placed in position before final inspection was requested. The answer to this argument on behalf of the architect is simple and fundamental. Custom cannot prevail in the face of positive law and conduct constituting the proximate cause of injury of one toward whom a duty of care is owed renders the wrongdoer liable in damages to the injured party, irrespective of whether such conduct is in accord with accepted standards and procedure in any given profession or professions."

The lesson to be learned from the Day case is that where there are injuries to third persons the engineer or architect, where negligent, will be held to the same rule of accountability as the owner and contractor.

Part 3. Miscellaneous liability

Some miscellaneous observations concerning liability may be of interest. Until recently, there has not been much litigation involving a plaintiff contractor and a defendant engineer or architect. However, in recent years a number of such suits have been instituted.

The argument has been made that the contractor is a third party beneficiary of the promise of the engineer or architect to the owner that he, the engineer or architect, will act in a certain way with respect to the contractor, such as, for example, timely approval of plans.

It has also been argued that the engineer or architect is personally responsible if he wrongfully interferes with the contractual relationship between the contractor and the owner as any one is legally liable if he knowingly does so interfere.

The question of lack of privity of contract has always been a stumbling block. In the light of the extension of the third-party beneficiary doctrine, the tendency of the courts to find a way to hold a person liable for his wrongs, as well as the natural extension of the Day case, previously discussed, it is suggested that there will be a considerable increase in litigation of this sort.

It will perhaps be possible to present to the courts the problem whether, aside from any question of fraud or of breach of a contractual obligation, an action can be successfully brought based on negligence in the making of representations of fact.[31]

While it is true that in England the rule has been established that "generally speaking there is no such thing as liability for negligence in word as distinguished from act," in this country the courts have tended towards, and have finally adopted, the more logical position that circumstances which impose an obligation on the part of one to another to use care in his acts, would impose the same obligation of care in the making of statements of fact upon which such other might rely.

Not every casual response, not every idle word, however damaging the result, gives rise to a cause of action. Liability in such cases arises only where there is a duty, if one speaks at all, to give the correct information. There must be knowledge, or its equivalent, that the information is desired for a serious purpose; that he to whom it is given intends to rely and act upon it; that if a statement is false or erroneous it may cause injury to another in person or property. This is what lawyers call the theory of negligent misrepresentation. It could be applied to the engineering and architectural professions.

Another interesting possibility presents itself with respect to the plaintiff contractor's problem of avoiding the exculpatory and notice provisions of a construction contract. These are the "fine-print" clauses that attempt to shift onto the contractor all responsibility for everything that does or does not happen. Such provisions, either by their terms or because a plaintiff contractor fails to comply with them, often effectively deprive a plaintiff contractor of the fruits of what otherwise could have been a successful suit against the owner. It has been suggested that when the actions of the engineer or architect have given rise to the cause of action, and the owner

has protected himself as noted, there may exist enforceable legal liability against the engineer or architect independently of the owner under conditions where the engineer or architect will not receive the benefit of the protection afforded the owner.

With the increasing awareness of juries that so-called "errors and omissions insurance" is obtainable, akin to their awareness of malpractice insurance for physicians, it could very well be that substantial recoveries will be had against members of the engineering and architectural professions.

The obvious conclusion is that engineers and architects, like ordinary businessmen, must more and more look to their insurance advisers and legal consultants for advice and aid in erecting protective barriers against claims of third parties arising out of or connected with the practice of their professions.

It seems to the writer that the various engineering societies should make an effort to approach this problem in a joint and cooperative manner so as to obtain a measure of protection to the profession. Individual members of the profession have devised various means of securing a measure of protection such as indemnity agreements from the owner or contractor or both, inclusion as one of the insured in various protective insurances obtained by the contractor or owner or both, and other devices that probably come readily to mind. If a uniform practice can be established by the professional societies, protective measures can undoubtedly be obtained more readily than if the matter is left to the individual engineer to bargain for in connection with his employment contract.

It is suggested that firm and vigorous action be taken now, before the trend toward increased litigation involving engineers and architects as defendants becomes so pronounced that a solution is made more difficult.

REFERENCES

[25] 217 N.Y. 382, 111 N.E. 1050 (1916).

[26] 10 M. & W. 109, 152 Eng. Rep. 402 (Ex. 1842).

[27] Inman v Binghamton Housing Authority, 3 N.Y. 2d 137, 143 N.E. 2d 895 (1957); Hanna v Fletcher, 231 Fed. 2d 469 (D.C. Cir. 1956).

[28] Bayne v Everham, 197 Mich. 181, 163 N.W. 1002 (1917).

[29] Paxton v County of Alameda, 119 Cal. App. 2d 393, 259 P. 2d 934 (1953).

[30] Day v National-U.S. Radiator Corp., 117 So. 2d 104 (La. App. 1959); application for rehearing denied Jan. 20, 1960.

[31] See Nichols v Clark, MacMullen & Riley, Inc. 261 N.Y. 118, 184 N.E. 729 (1933); Ultramares Corp. v Touche, 255 N.Y. 170, 174 N.E. 441 (1931).

TITAN

The Titan missile is aptly named. Characteristic of the colossal size and enormous strength of the family of giants described in Greek mythology, the Titan is the largest of our intercontinental ballistic missiles. It stands over 95 ft high and weighs about 110 tons. Capable of placing a nuclear warhead on a target more than 6,000 miles distant, the Titan will play a giant role in deterring aggression.

Facilities for housing a family of nine such missiles are now being constructed for the USAF near Larson Air Force Base, in Washington, by the U. S. Army Corps of Engineers Ballistic Missile Construction Office. The colossal size of the construction project is shown by the following statistics.

To place all structures underground, some 160 ft deep, two million cubic yards of excavation are required, including a half million cubic yards of rock.

To provide shelter for the missiles and the equipment that operates them, 120,000 cu yd of concrete with 13,000 tons of reinforcing steel will be placed, including 500 tons of rock bolts to anchor the structures.

To protect the missiles, equipment and men from the ground shock of an enemy nuclear strike, 5,000 tons of structural steel will be utilized for the spring-mounted stairs, elevators, floors and other supports required by the weapon system.

Finally, to make the system completely independent of outside utilities and environment, it will have its own systems for heat, power, fuel storage, water and a filtered, air-conditioned atmosphere throughout.

This is a titan project in every respect.

Subsurface exploration

Larson Air Force Base is almost in the center of the vicinity map, Fig. 1. The missile sites are designated as complexes, with three missiles at each of the complexes identified as 1-A, 1-B and 1-C. It is significant that the straight-line distance separating one location from another in all cases is greater than 20 miles. Through dispersion, the effects of a nuclear attack on the general area would thereby be minimized, and should an enemy knock out any one complex, we would still have an ability to retaliate.

Other factors considered in selecting the missile sites were: proximity to

One Titan ICBM complex is seen in open cut. Antenna silos are in foreground. When completed, the three complexes will be buried under 2 million cu yd of backfill.

construction for the Titan missile

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a home base, which is Larson Air Force Base; distance from centers of large population, such as Spokane, Seattle and Portland; compatible topography, which is plentiful in the Columbia Basin; and nearness to usable access roads.

Sites having been selected by the Strategic Air Command and land having been acquired by the Corps of Engineers, work began in the spring of 1959 to explore the subsurface conditions at each site. Core borings and seismic investigations revealed rock at all sites.

At site 1-A this rock, a basalt common to the region, began at about 60 ft below the surface of the ground and continued downward indefinitely. This meant drilling and blasting through 100 ft of rock to construct the vertical shafts, 45 ft in diameter, that will house the missiles. At site 1-B rock interferes for 123 ft, and at site 1-C for 139 ft.

These explorations naturally influenced the subsequent design of the structures at each complex. It stands to reason that they also influenced later bids on construction.

Concurrent with the geologic exploration, the development of water wells proceeded. The objective was to develop two wells at each complex, with a yield of not less than 165 gpm from each well. Using cable-tool rigs, drilling began in April 1959 and continued 24 hours a day, 7 days a week until late January of 1960, when the sixth and last well was tested and accepted. Depths of wells vary from about 500 to 1,000 ft. In each case the yield is adequate. The cost per well was about $120,000.

A missile complex described

The layout of one missile complex is shown in Fig. 2. The size of the plot is actually about 1,000 ft in width by 1,500 ft in length (south to north), or roughly 34½ acres. Numbers 1, 2 and 3 identify one complete and independent launcher unit.

The missile silo, No. 1, is a concrete cylinder with walls 2½ ft thick. It is 45 ft in diameter and goes into the ground 160 ft—big enough to contain and conceal a modern 13-story office building. It houses one missile, which is mounted on a shock-resistant, hydraulically operated elevator. The missile, together with its umbilical tower, launcher platform and flame deflector, represents a gross load of about 300 tons.

The concrete shelter that will house one missile will require 4,000 cu yd of reinforced concrete. This includes the protective biparting doors that will be cast in place flush with the ground surface. Each leaf is 24 ft wide, 19 ft long and almost 4 ft thick. Their total weight is about 270 tons.

Other features of the missile silo are a footing ring 5 ft thick and 6 ft wide throughout its circumference of 141 ft; a beefed-up concrete collar at the surface, 11 ft thick and 39 ft deep, to withstand the effects of a nuclear ground burst; and about 100 rock anchor bolts, each 3 in. in diameter, with a 27-ft embedment in underlying rock, to anchor the silo in place. The cost of one silo, less the missile and its elevator, is nearly $1 million.

The equipment terminal, No. 2, and the propellent terminal, No. 3, are adjacent to the missile silo. These structures, also silos, service the missile. The propellent terminal stores the liquid oxygen, nitrogen and helium that pressurize and power the missile; the equipment terminal contains the machines that load the missile and operate the elevator preparatory to launching. The cost of the two is about $800,000.

The sketch shows two clusters of structures labeled Launcher 2 and Launcher 3. Each is identical to the one just described. They accommo-

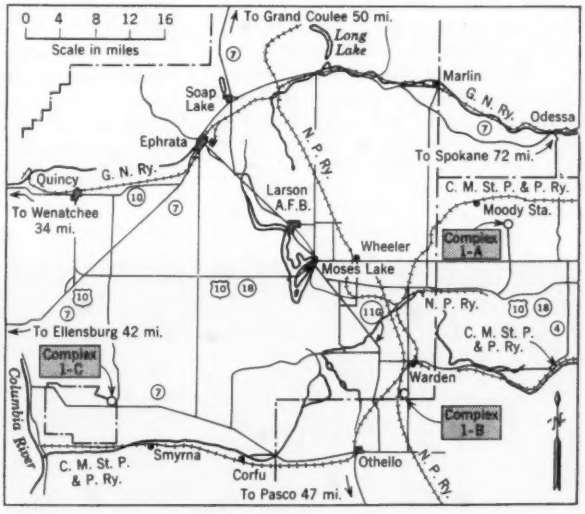
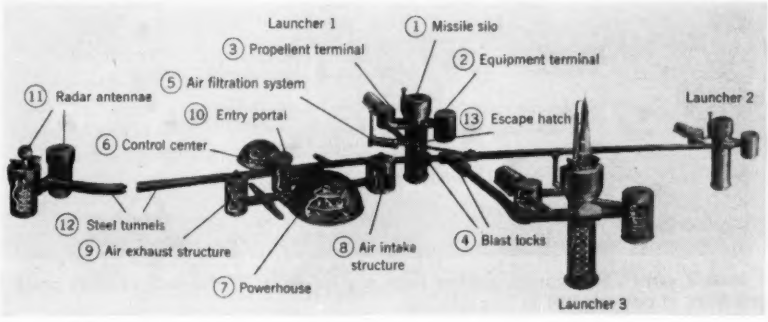
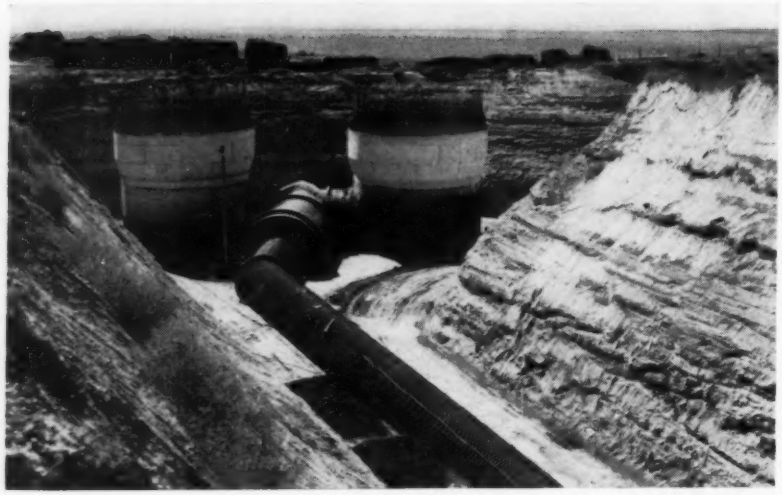


FIG. 1. Vicinity map shows geographical layout of three missile complexes. Widely dispersed sites offer a poor target for enemy attack.

FIG. 2. In the Titan complex all structures are underground, and protective doors of three missile silos are flush with the ground. One missile is shown in raised position ready to launch.





Two antenna silos are connected to personnel tunnel leading to the other structures by 42-ton tunnel junction. These structures will be completely covered with backfill.

date the two additional missiles that complete the complex. Separated one from the other as they are, the blast effects of an accidental explosion of one missile, either in its silo or in the above-ground launch position, will not damage the others.

Blast locks, No. 4, provide further protection. There are two of them, both identified as No. 4 in Fig. 2. They are massive concrete chambers with heavy steel doors designed to arrest blast effects which would otherwise be transmitted through the tunnels that connect the three launcher units. Each chamber is about 75 ft long and 16 x 17½ ft in section. Walls, floor and ceiling are reinforced concrete, 2 to 4 ft thick. The cost of the two locks is over $300,000.

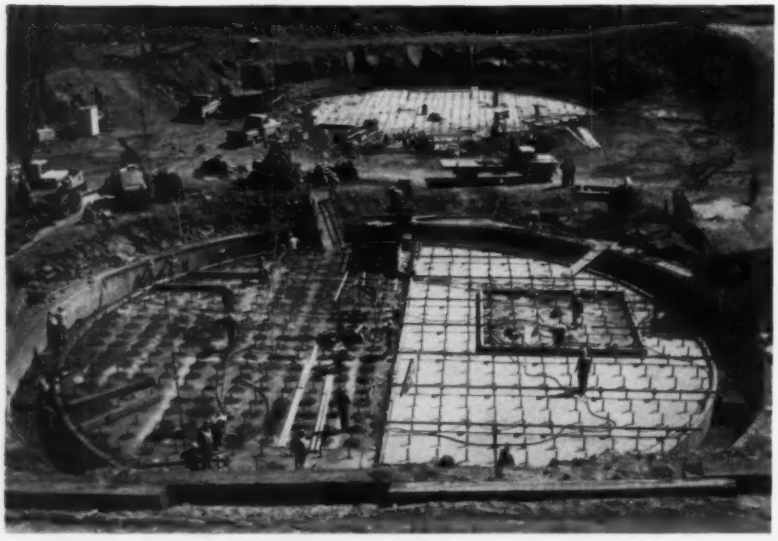
The air filtration structure, No. 5, is located about 40 ft below grade. It draws outside air through a steel shaft 5 ft in diameter and distributes a dust-free atmosphere through ventilating tunnels connecting with the launcher areas. The filtration system is of special importance in removing radioactive particles resulting from an enemy nuclear attack. In addition to revitalizing the inside air, the system establishes definite air-flow patterns to control hazardous vapors. Waste air is exhausted through shafts in each launcher area, where accumulated fumes can be purged most rapidly. Both intake and exhaust are provided with fast-acting blast valves designed to sense shock and close the system before the impact of a nuclear blast.

The control center, No. 6, is a concrete dome completely buried under 17 ft of earth. It houses the instrumentation and the controls which load, raise and fire the missiles. It is here that data are computed and fed to a missile through the radar during the guided part of a missile's flight. All equipment within this structure will be isolated from shock by a system of spring beams, which makes use of double cantilevered beams supported by pendulum struts. Deflection of the spring beams, which support the rigid two-level cage containing the equipment, will attenuate vertical shock, while the pendulum action of the struts will allow horizontal motion. The cost of this structure is about $700,000.

The powerhouse, No. 7, is a concrete shell completely buried in the ground—like the control center. Its air intake and exhaust structures are Nos. 8 and 9 respectively. At its base the powerhouse is 130 ft in diameter and it is 60 ft high. Nearly 5,000 cu yd of concrete and 800 tons of reinforcing steel will go into this structure. It will house four 1,000-kva diesel-powered generators, plus the pumps, compressors, water chillers, ice banks and other equipment necessary to make the complex independent of outside utilities and environment. (The openings for the two water wells are in the powerhouse floor.) All the machinery within this structure will be shock-tested at the place of manufacture, and on installation will be spring-mounted in the same way as the equipment in the control center. The cost of one powerhouse, less the machinery, is $2½ million.

The entry portal, No. 10, provides access from the surface to the underground complex. It is a shaft nearly 40 ft in diameter and 70 ft deep. The stairs and equipment elevator, both spring-supported and shock-resistant, connect with the tunnels 40 ft below the ground. An automatically controlled hydraulic unit operates a concrete hatch which seals the shaft at ground level. The hatch is provided with de-icing gear and is regulated electrically to prevent it from opening simultaneously with the nearest blast door in the tunnel. The cost of one portal is nearly $300,000.

The antenna silo, No. 11, houses the radar which transmits and receives electronic data during the guided part of a missile's flight. It is the point of contact between the control center



In control center, foreground, anchor bolts are in place. Water-well casings project from floor of powerhouse in background.

and a missile after it is fired. Two are shown in the sketch. One is a spare to be used in the event that the other is damaged by an enemy strike after being raised to the tracking position. Each silo is 40 ft in diameter and 70 ft deep. Protective doors are flush with the ground and are similar in construction to the doors of the missile silos. The cost of the two silos is about $300,000.

A network of steel tunnels, identified by No. 12 in Fig. 2, interconnects all structures of the complex. The tunnels wind their way for almost a half mile 40 to 50 ft below the surface of the ground. Varying from 8 to 9 ft in diameter, they permit the movement of men and equipment underground, in addition to carrying the conduits that distribute utilities throughout the complex. Fabricated off-site in 50-ft lengths, the corrugated steel tunnel sections will be placed in trenches and bolted end to end. They will be waterproofed, strengthened and provided with blast doors at all junctions. The cost of the tunnel network is about $5 million.

The emergency escape hatch, No. 13, is nothing more than a 10-gage corrugated steel pipe 3½ ft in diameter connecting vertically with the blast lock nearest the air filtration structure. A heavy steel manway door seals the shaft from the blast lock, and a continuous ladder is fixed to the wall of the shaft for access to the surface. In the event that emergency exit is necessary, a hydraulic pump will release the locking devices that secure the manway door. When the door is released, the protective sand fill in the shaft will fall into the chamber of the blast lock thereby clearing the shaft for exit.

Methods of construction

One of the complexes is shown in the photograph on page 50. In the foreground are the antenna silos. Proceeding upward, the trace of the tunnels leads to the area of the control center and powerhouse, the powerhouse being on the right. Branching out from there, through the area of the blast locks, the trace of the tunnels leads to the three launcher units.

Notice the ramps leading to each cluster of structures. These provide access during construction. Notice also the slopes of the excavation down to the structures and the trace of the tunnels. These mark the open cut.

The open cut stands on a slope of about ¾ horizontal to 1 vertical. From the original ground surface the excavation goes down about 35 ft to the level where all shaft work and tunnel trenching begin. The cut represents nearly 2 million cu yd of material that had to be removed. About 350,000 cu yd of this was rock; the remainder was for the most part caliche, except for about 10 ft of overlying loose sand and silt. Below the 35-ft level, an additional 170,000 cu yd of rock had to be drilled, blasted and removed to make room for the 33 silos and the 1½ miles of tunnels. Of this, about 100,000 cu yd came out of the shafts; the rest came from trenching.

Control center, foreground, has two wall lifts in place, and formwork for dome construction. Second structure is powerhouse; note forming for tunnel entrance.

Progress and future construction

The first cut for the excavation was made on December 1, 1959. Since then the job has stayed on schedule. Working six days a week, usually one, but sometimes two or three shifts each day when necessary, the contractor has completed all shaft work and has placed more than 100,000 cu yd of concrete.

Concreting started late in February 1960. Placement continued through March of this year. Only the missile silo doors have yet to be poured, and they should be placed this month. The first tunnel junction was delivered in May 1960. The task of placing the network of tunnels and connecting them with the various structures was finished last month. All major structural work is now complete.

Installation of the mechanical and electrical systems began last June and will continue through July of this year. Operating tests of these systems should be completed shortly thereafter. Concurrent with these tests, various ground-support equipment to operate the weapon system will be integrated into the construction.

Backfilling has been a progressive operation. It has kept abreast of tunnel installation and concrete placement. All backfill is in place at complex 1-A; the other two complexes are nearing completion. It has taken one year and about two million cubic yards of earth to bring all the sites back to finished grade. Soon all that can be seen of a missile complex above the ground will be a guard house for a sentry at the entrance gate.

The completed Titan base at Larson is scheduled for turnover to the Air Force in the spring of 1962. The Corps of Engineers and the contractor share in the determination that, barring an act of God or a failure of industry, this job of titan proportions will be completed on schedule. Then, God grant that we may never have to use it.

Contract award

Facilities for the Larson Titan Project were designed by the Ralph M. Parsons Company of Los Angeles under contract to the Air Research and Development Command. Plans and specifications for the complexes were approved jointly by the Air Force and the U. S. Army Corps of Engineers.

Following the award of the construction contract, 27 separate supply contracts totaling nearly $5 million were let by the Omaha Engineer District for the manufacture and delivery of the pumps, compressors, air-conditioning equipment, switchgear, generators, liquid-oxygen tanks and other equipment standardized for the Titan weapon system. The responsibility for installing this equipment and the responsibility for administering the related contracts rests with MacDonald-Scott and Associates of St. Louis, Mo., who are the prime contractors.

Portion of the sea wall is seen before backfilling, with sheetpiles, wales, tie-beams and anchor piles in place.

The finished structure presents a most pleasing appearance for a resort area. Only the slab was cast in place.

PRESTRESSED CONCRETE FOR A SEA WALL

ROSS H. BRYAN, F. ASCE, Consulting Engineer, Nashville, Tenn.

Prestressed concrete sheetpiles, held by prestressed wales and tie-beams—with all connections made watertight—protect 1,840 ft of sea frontage at Folly Beach Ocean Plaza near Charleston, S. C.

The sheetpiles are 26 ft 6 in. long, 3 ft wide and 10 in. thick. The tie-beams are set 4 ft 6 in. below the top of the sheetpiles. See Fig. 1. Moments in the sheetpiles are reduced to a practical minimum by making each pile 5 ft longer than needed for protection to take advantage of fixity at the bottom. This also gives a factor of safety against possible erosion. With this arrangement, 12 strands of wire 7/16 in. in diameter, with No. 3 (3/8-in.) hoops 10 in. on centers, are adequate reinforcement. See Fig. 2.

A bottom corner of each sheetpile was beveled to aid in forcing it against the pile previously installed as it was jetted into place. A tongue-and-groove key was built into the pile from the bottom to 1 ft below beach elevation to keep the wall in line and key the piles together. See Fig. 2. From the beach line to the top of the piles a double key was left open for in-place grouting to prevent loss of backfill from between the piles. A tolerance of ¼ in. in the 3-ft width of the piles was permitted to take care of "gain" in installation. This was found to be about the correct amount.

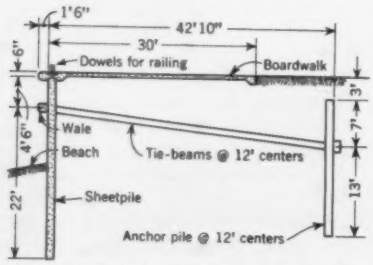


FIG. 1. Typical section through sea wall.

The wale is a continuous beam on the ocean side of the sheetpiles. It is 18 in. square and was cast in lengths of 48 ft as a four-span continuous beam using 20 prestressing strands of 7/16-in. diameter. The wale is tied to the anchor piles, spaced 12 ft on centers and 43 ft back from the wall, by a 14 x 14-in. tie-beam prestressed with six strands of 7/16-in. diameter. A sleeve nut for a bolt of 2½-in. diameter was anchored into the ocean end of the tie-beam (Fig. 3).

The other end of the tie-beam was connected to an anchor pile by a bolt of 2½-in. diameter, inserted through an opening in the pile. The anchor piles are 20 ft long, 4 ft wide and 12 in. thick, with their tops 3 ft below the permanent grade. Each of these piles required 32 prestressing strands of 7/16-in. diameter wire and had No. 3 reinforcing ties spaced 12 in. on centers.

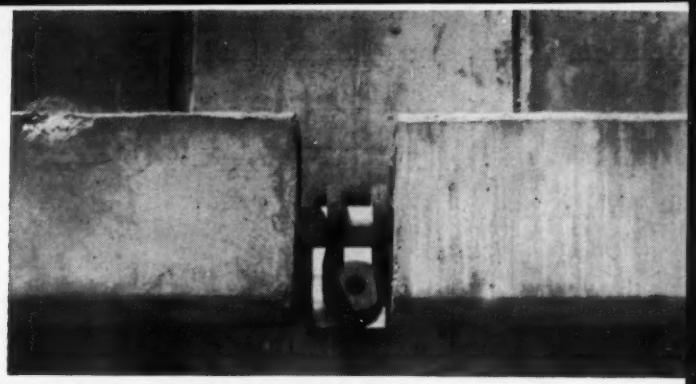
Eight subsurface borings, to depths as great as 51 ft, were made by Soil Consultants, Inc., of Charleston to obtain design data. The logs of all holes were quite similar; the top 23 to 28 ft of depth consists of medium sand with fine shells. Below this there is organic clay to a depth of 43 ft, and under that more sand.

Passive pressure for the anchor pile was computed using a phi value of 26 deg and a buoyant weight of 50 pcf. The tie-beam is connected to the anchor pile 7 ft below the top of the pile to reduce bending moments and increase stability. The same values were used in computing pressures on the wall due to the backfill, which is sand dredged from the nearby Folly River. A phi value of 32 deg and a buoyant weight of 70 pcf was used in computing passive pressures at the bottom of the piles.

To provide against possible movement in the wall, an unusual arrangement was devised to connect the ends of the wales to the tie-beams. A galvanized pipe sleeve was cast in both ends of the wales. As the wales were installed, a 4-in. galvanized pin, on a No. 8 clevis, was slipped into the pipe sleeves. The clevis was then connected to the tie-beam by a rod of 2½-in. diameter with right and left threads. This rod was threaded into the sleeve nut anchored in the tie-beam. At intermediate 12-ft intervals, a rod was attached to the wale through a pipe sleeve. See Fig. 4.

All the exposed rods and their points of connection to the precast

Sheetpiles were held in position during jetting by a frame dragged along by the crane.



Connection at end of wale is shown before reinforcing steel was placed in joint, and before joint was packed with grout.

members were carefully cleaned and the joint around them packed tightly with grout to prevent the entrance of water, which would cause progressive corrosion.

A cast-in-place concrete slab 5 in. thick, 31.6 ft wide, and over 1,500 ft long, is used for the "board-walk" at Folly Beach. The slab extends slightly beyond the face of the wall; it is tied to the wall by pieces of 7/16-in.-diameter strand, grouted into the keyways between the sheetpiles, and also by the looped strands which were cast into the ends of the sheetpiles for handling.

This sea wall is part of a $3,000,000 development that is planned for Folly Beach Ocean Plaza, Inc., financed by a group of Charleston businessmen. The amusement plaza has an arcade building, with a miniature golf course on the second floor. There is a bingo building, a snack bar, 12 concession stands and other structures. The buildings were built with prestressed ledge-type beams and prestressed double-T slabs 8 in. deep. All the buildings are on 20-ton creosoted timber piles.

For this project, the architect was Demetrios C. Liollio, the general contractor, the Ruscon Construction Company, and the prestressed concrete fabricator, the Pre-Stress Concrete Company, all of Charleston, S.C. The structural plans were prepared under the direction of B. M. Gray, in the office of Ross H. Bryan, consulting engineer of Nashville, Tenn.

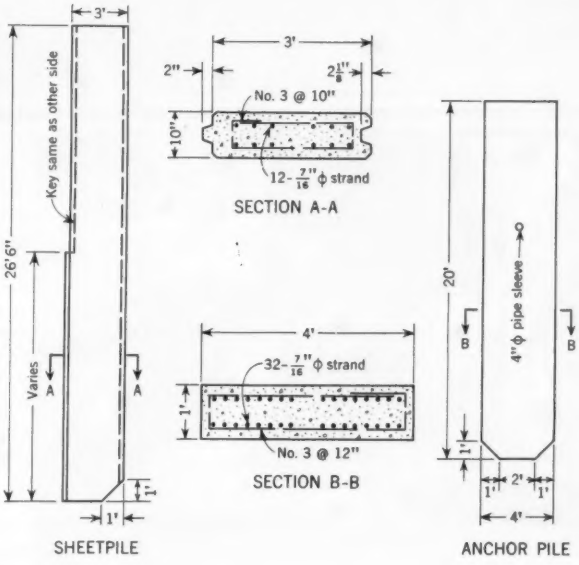


FIG. 2. Sheetpile details left, and anchor pile, right.

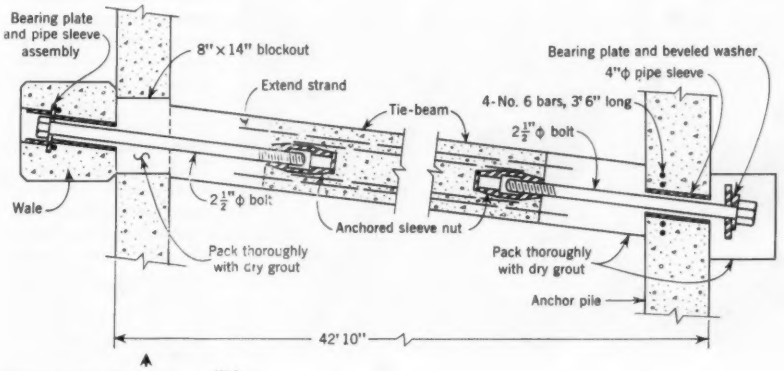


FIG. 3. Typical tie-beam connection to wale and to anchor pile. Sheetpile reinforcing is omitted.

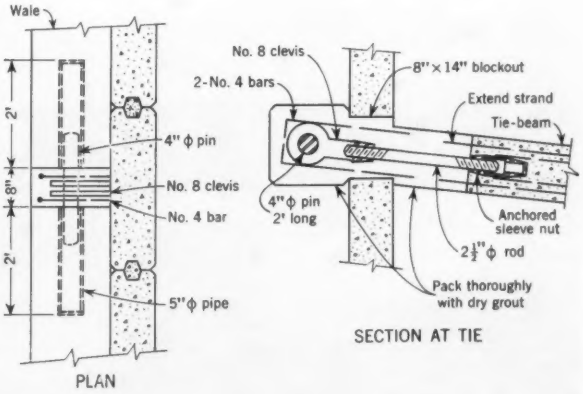


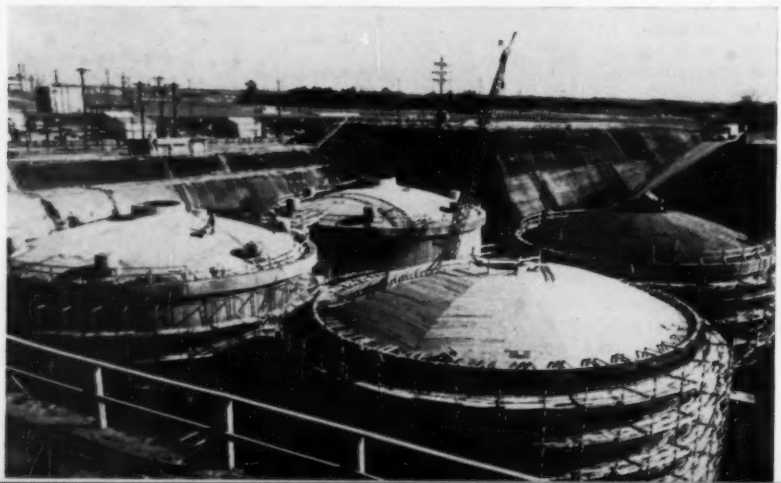
FIG. 4. Connection of wales to tie-beams at discontinuous ends of wales. Sheetpile reinforcing is omitted.

Radioactive wastes
VIEWED IN PERSPECTIVE

ARNOLD B. JOSEPH, Sanitary Engineer, Environmental & Sanitary Engineering Branch
Division of Reactor Development, U. S. Atomic Energy Commission, Washington, D. C.

◀ **A fiber drum of solid radioactive waste is being placed in a bin vault for storage at the Argonne National Laboratory in Idaho. Concrete plugs 1 ft thick are used to close the bin and minimize radioactivity above the vault.**

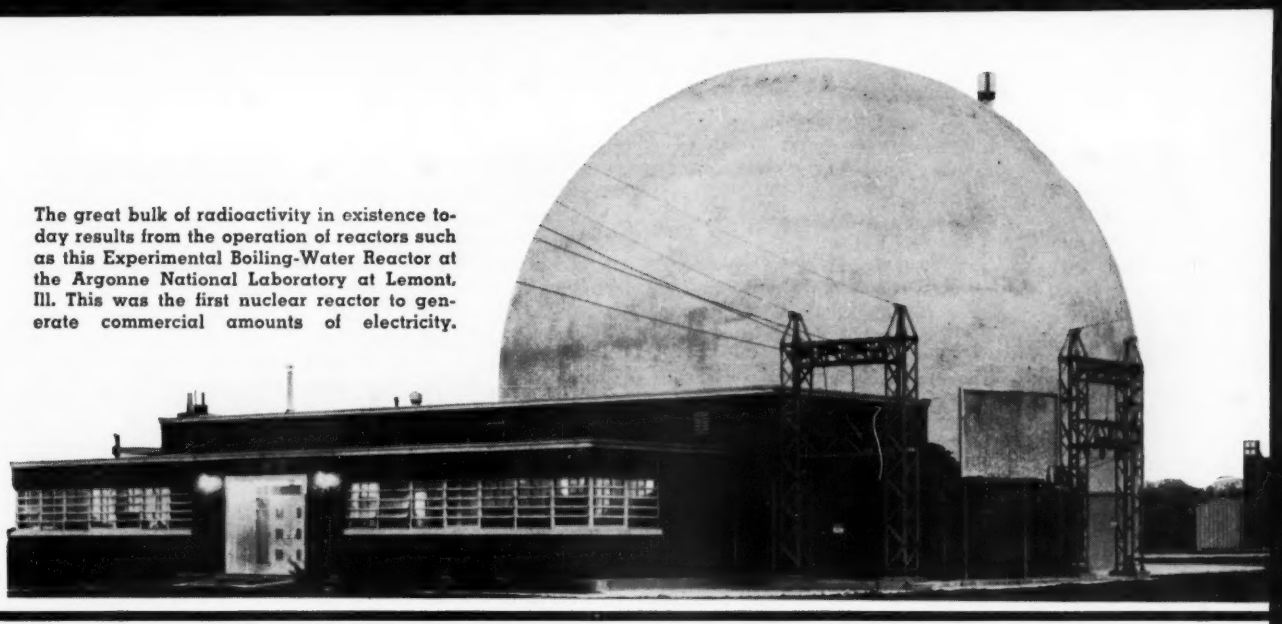
Four 1,3000,000-gal storage tanks for high-level radioactive wastes are shown under construction at the Savannah River Plant of the AEC. The concrete and steel tanks are 85 ft in diameter and 34 ft high. Each tank rests on a steel saucer which in turn rests on a 6-in. concrete pad. There are 20 such tanks ranging in size from 750,000 to 1,300,000 gal in AEC's South Carolina facility. ▼



Because of the form in which atomic energy was first used, as a weapon, most people in the world associate the well-known mushroom cloud with anything having to do with atomic energy. The atomic weapon did give those responsible for fostering atomic energy programs cause for conservatism and caution. We in the Atomic Energy Commission believe atomic energy has a place in the world and that one of our major tasks is to show how this can be done safely. Of prime importance in this respect is the disposal of radioactive wastes, and this is not a simple, single problem with a single best solution.

There are almost as many kinds of radioactive wastes as there are radioisotopes. Technically, the way a particular radioactive waste is handled is dictated by the nature of the specific waste material under consideration and by the rules and specifications that are necessary for safety. Of course, technical considerations are often modified by administrative ones —such as public acceptance and reaction. The operating criteria—the radiation protection guides—followed by the AEC are those developed and recommended by the National Committee on Radiation Protection, the International Commission of Radiological Protection and the newly established Federal Radiation Council. It has always been the policy in the atomic energy program to expose as few people as possible to as little radioactivity as possible.

The many kinds of radioactive wastes in the atomic energy industry have evolved from many kinds of operations such as mining of uranium; chemical and metallurgical reactor fuel-making operations; operations



The great bulk of radioactivity in existence today results from the operation of reactors such as this Experimental Boiling-Water Reactor at the Argonne National Laboratory at Lemont, Ill. This was the first nuclear reactor to generate commercial amounts of electricity.

with research, power and production reactors (both air and water cooled); and of course, laboratory and experimental programs associated with such operations and with research in just about all the physical and biological sciences.

Two methods of handling wastes

Actually, there are only two practical methods of handling the wastes and physically placing them where we can be certain they won't adversely affect man or his environment. If it is admitted that we can live with limited amounts of radioactivity, as suggested by the National Committee on Radiation Protection, then the dilution capacity of the environment becomes a recognized means of dispersal. So long as the concentrations of radioactivity in the air we breathe and the water we drink remain below the levels recommended as safe by the National Committee on Radiation Protection, this is considered a satisfactory method of disposal. This concept can be called "dilute and disperse." The other practical method can be termed "concentrate and contain." That is, the radioactivity is compressed, evaporated or otherwise concentrated to as small a volume as possible and placed in a tank, trench, or other storage place. Of course, neither of these procedures totally "gets rid" of the radioactivity at the time of disposal.

Radioactive wastes may be evolved in any physical state—liquid, solid or gaseous. These may also be classified according to level of radioactivity, that is, wastes may be of low or high activity. Low-activity wastes are defined as those that present no particular hazard to persons nearby. Low-activity material can be handled directly without undue consideration of time of contact. High-activity wastes are those with an amount of radioactivity that materially limits the time a person can be near the radiation source. As a minimum we now have six permutations of these waste classifications—high and low activities of liquid, solid and gaseous wastes.

Laboratory wastes

Low-activity wastes most commonly come from laboratories using radioisotopes. For example, in hospitals and clinics, radioiodine is administered for treatment of thyroid and radiophosphorus is used for treating some bone diseases. These and other radioisotopes are particularly valuable as tracers in the earth sciences as well as in the biological sciences. These low-activity wastes are the products and residues of experiments and are discarded after the experiments are finished. Laboratory equipment that comes in contact with the radioactive source is usually washed and decontaminated and put back in service. However, the wash solution then contains the activity.

Liquids, if small in volume, are usually segregated and collected in bottles ranging in size up to 5-gal carboys. From here on out, the liquid wastes may be handled in any of several different ways—depending on the concentration of radioactivity. The full container is first assayed to determine the concentration of the radionuclides. If it is low enough and otherwise meets the criteria in Chapter 10 of the Code of Federal Regulations, Part 20 (the AEC regulation governing licensee disposal operations), it may be diluted and released to the sanitary sewer system. If the activity is deemed too high for this method, the liquid may be mixed in concrete or with a chemical gelling material such as Aquagel to solidify it and make it easier to package for shipment to a burial site.

If the laboratory evolves large volumes of radioactive liquids—too much to be conveniently handled by the carboy method—it is usually fitted with a separate waste piping system, which drains to detention or hold-up tanks. Again, when a container is filled, the first step is to determine the concentration of the activity. If it is low enough, the liquid may be flushed into the sanitary sewers. If it is too high for this treatment, the liquids are usually piped or trucked by tank truck to a liquid waste treatment facility. Depending on the chemical nature of the liquid waste, the radioactivity may be removed (called decontamination) by ion exchange, co-precipitation or evaporation. The decontaminated liquid is again monitored and if the radioactivity is low enough, it is released to the sewerage system. The concentrated activity, now in slurry or sludge form, is solidified, packaged and shipped to a burial site.

Solid wastes, such as contaminated kim wipes (used for cleaning up in the areas where isotopes are used), blotting paper, rubber gloves, beakers and other laboratory paraphernalia not worth decontaminating, are usually packaged in large boxes or 55-gal drums and shipped to a waste burial site—either at sea or on land.

At present, land burial facilities are located at five of the larger, AEC-owned contractor-operated installations: Oak Ridge, Tenn.; Savannah

River, S. C.; Los Alamos, N. Mex.; the Idaho National Reactor Testing Station, Idaho Springs; and Hanford, Wash. The Oak Ridge and Idaho sites bury their own packaged wastes and those of other AEC contractors and licensees. Small plots of ground on these sites are set aside as "cemeteries" for this purpose. Less than 100 acres at each site will take care of wastes for the next 10 years at present rates of use. It is anticipated that these areas will be dedicated to this purpose for a long time to come—possibly hundreds of years—until the longer lived radioactivity decays to essentially background levels.

Reprocessing plant operations

In comparison to laboratory wastes, the wastes from reactors and chemical reprocessing plants are more complex. Here are evolved both high and low levels of gaseous, liquid and solid wastes.

There was a time, back in the 1940's, when gaseous wastes were a real problem. However, as a result of an AEC-sponsored research and development program, air cleaning units, such as high-efficiency filters capable of removing 99.95 percent of particles 0.3 microns in diameter, were developed and put into commercial production.

Liquid wastes from reactor sites are more varied than those from individual laboratories doing tracer experiments. These are not only different in volumes, but also may contain, in any single waste stream, a greater variety of isotopes.

The great bulk of the radioactivity in existence today results from the operation of reactors. When a fuel element has been in an operating reactor for a certain time, daughter fission products such as xenon build up and actually poison the chain reaction by absorbing the neutrons necessary to sustain the chain reaction. So the fuel element must be removed and processed to remove these poisons and to recover the unfissioned uranium, which is quite expensive.

In the solid-fuel element, before chemical separation, the concentration of fission products—the elements with mass numbers from 70 to 162—ranges from 100 to perhaps 1,000 ppm. After processing, the fission products are considerably diluted by solvents, acids, water, salts and other solids. The resulting fission-product concentrations even after evaporation are quite dilute. But because of the radioactive nature of these elements, the waste streams may contain quantities of radioactivity in the tens and even hundreds of curies per gallon—depending on the composition of the particular fuel element and the type of chemical separation process. Without any dilution, it will take several hundred years for isotopes with the longer half-lives, such as those of strontium and cesium, to decay to concentrations permissible in drinking water.

The disposal of the first-cycle liquid wastes which result from the reprocessing of irradiated reactor fuel elements, is *the* waste disposal problem in the atomic energy industry which is receiving the most attention today. At present all these wastes (about 60 to 70 million gal) have been stored in underground tanks. None have been discharged to the environment either on land or at sea. Moreover it is predicted, that in the future we can look forward to the production of many millions of gallons of these wastes every year.

Tank storage in itself is not a bad way to control these materials. But tank storage has some restrictive limitations such as the life of the tanks and the large number of dollars for constructing, maintaining and monitoring the tanks, which motivate us to look for better methods to really "get rid" of these hazardous wastes. The structural life of these tanks, engineers say, can be expected to be only tens of years whereas the wastes will be radioactive for hundreds of years. If to these limitations is added the fact that the potentially hazardous radioactivity is in a fluid state and thus rather mobile, our cause for concern is evident.

Several ideas have been proposed for safe, suitable and practical methods to dispose of these wastes. Some are based on reducing the mobility of waste in the environment and others on reducing the hazard potential by carefully storing the wastes in selected environments. The following ideas are in the exploration and development stage at this time.

Fixation in inert media

One method considered is to fix the radioactive waste material in an inert solid carrier so that the possibility of migration into the environment is eliminated or reduced to acceptable limits. The carrier containing the radioactive material could then be permanently stored or buried in a selected location without deleterious effect on man or his resources. Fixation on clay, incorporation in feldspars, conversion to oxide and conversion to oxide-elutriation of oxide to remove leachable fission products and subsequent fixation of these fission products, are all examples of this principle of waste treatment now under development. Problems with these fixation processes now under study have to do with the relatively high temperatures inherent in this method of treatment. There is volatilization of certain nuclides—cesium, for example—and the control of ruthenium and other active aerosols which necessitate further air cleaning development. In addition, there are corrosion problems caused by acid wastes.

Separation of certain isotopes

Because of the particular radiotoxicity and long half-life of strontium-90 (28 years) and cesium-137 (27 years), the removal and separate fixation and handling of these two isotopes would substantially reduce the effective life of the remaining material and facilitate its final disposal. With cesium and strontium removed, the possibilities of safe disposal of the remainder (and bulk) of the wastes into the environment under controlled conditions are greatly improved. Of course, an added incentive to this plan is the economic utilization of the separated fission products, particularly cesium, because it has fairly energetic beta and gamma emissions and a 27-year half life which makes it useful as a radiation source. Here we have the same high-temperature air cleaning problems as with fixation.

Disposal to geologic formations

Preliminary studies indicate the possible technical feasibility of direct disposal of highly radioactive liquids into the ground even taking into account the unique characteristics of these wastes. It may be proved practical to dispose of the wastes underground in some cases without any treatment, into such formations as: (1) spaces prepared by dissolution or excavation in salt beds or salt domes. Non-radioactive field experiments in an actual salt mine with simulated wastes have been successful in proving the feasibility of this method. The next step—experiments with radioactive tracers, is being planned; (2) deep basins (5,000 to 15,000 ft in depth) containing connate brines and with no hydrologic connection to potable waters or other valuable material resources; (3) special excavations in selected shale formations.

Two major problems associated with such direct disposal schemes appear to be: (1) the physical and chemical compatibility of the wastes and the material in the geologic formation; and (2) control of the thermal heat due to radioactive decay. Recent studies at the University of Texas and at Oak Ridge National Laboratory in-

Bags of low-activity wastes are evaluated before being placed in barrels for concreting at the Lawrence Radiation Laboratory at the University of California.

Fifty-gallon barrels of radioactive waste are stacked in pits at Idaho National Reactor Testing Station. A trench for random dumping of routine wastes can be seen in the background.

dicate that the problem of thermal heat can be engineered out. At present, disposal into salt structures appears to be the best possibility. Salt structures are a particularly uniform geologic formation and are dry, impervious to water and not associated with useable ground-water sources. They behave as plastics under load and are considered by many as a sort of self-sealing storage tank.

Other possible disposal methods

Ocean disposal is considered acceptable for limited quantities of low-activity wastes in defined segments of the ocean. However, oceanographers have pointed out that the dilution or diffusion mechanisms and patterns of dispersion over all the interconnected oceans of the world are not totally predictable, which becomes an overriding factor when you consider millions of times more activity. For example, little is known of the top-to-bottom circulation in 2,000 fathoms, except that it is of the order of 100 years or more. The degree of reconcentration of specific isotopes in certain marine forms and the long-term effect on marine ecology also becomes more important when levels of activity in the ocean approach calculated maximum permissible levels. If to these uncertainties are added the very great engineering problems of just packaging and transporting large quantities of hazardous radioactivity in liquid form and handling this on a rolling platform at sea, it can be seen why sea disposal is considered as a secondary possibility at this time as a major means of waste disposal.

Transportation aspects

Low-activity wastes are often transported from facilities with small land areas to other sites or to the oceans for disposal. For all intents and purposes these are the only wastes that are stored in tanks near the chemical processing plants where they are produced. However, the input to these plants—the irradiated reactor fuel elements—is shipped from the reactors. These are transported in lead-lined steel containers. All these shipments are made by rail, truck, air and water under the regulations of the Interstate Commerce Commission, the Federal Aviation Agency, the Coast Guard, and the Atomic Energy Commission.

There are two practical problems associated with shipping irradiated fuel elements—radioactivity and thermal heat. The radioactivity is considered as both an internal and an external hazard. Because it is so intense it requires 6- to 12-in. shields of lead. The lead also acts as an insulator of the heat generated by radioactive decay. The heat is conducted from the fuel elements to the atmosphere by a fluid coolant—usually water. If the heat were not dissipated, the fuel elements conceivably could generate enough heat to melt themselves. Since the coolant may be contaminated from contact with the fuel elements, it must be completely contained. The containers are loaded and unloaded under water in what are called fuel-element storage or "swimming" pools.

We visualize that in any case there will be shipments of spent fuel elements from reactors. There may or may not be shipments of wastes from processing plants. The ultimate disposal method finally adopted will determine whether wastes need to be transported. For example, if disposal of high-activity wastes to geological formations proves feasible, it may be that the chemical processing plant will be constructed at the disposal site. Because such shipments are unique and there is not a long experience to draw upon—the industry being only 15 years old—the AEC has had to turn to research and development studies to determine the safest shipping methods and to ensure their being used.

A study team at John Hopkins University is conducting an operations analysis of the factors affecting the safety of radioactive shipments. Factors such as design of containers, integrity of containers under normal and accident conditions, nature and amount of material being moved, frequency and severity of accidents, radiation damage, selection of routes, employment of escorts and special communications are being applied in a mathematical model in order to get a realistic understanding of their interrelationships. The Franklin Institute of Philadelphia is conducting studies on the integrity of spent-fuel-element containers under dynamic accident conditions. More will be heard of these studies in future because their application will be universal.

In conclusion, even from the waste-disposal point of view, we must expect to see changes in our physical world. There will be remote waste processing and disposal plants which receive small shipments in big containers, monitoring facilities up and down the land, and burial grounds set aside to be more permanent than those we now know. However, the most important factor bearing on our everyday lives which comes from the waste disposal business to date is an increased awareness of the actions and interactions of the air we breathe and the land and water on which we live.

(This article was originally presented by Mr. Joseph as a paper at the ASCE Boston Convention, before a session of the Sanitary Engineering Division.)

GOOD INDUSTRIAL FLOORS:

What it takes to get them and why

C. FRED YTTERBERG, Aff. ASCE, President, Kalman Floor Company, New York, N. Y.

THE FIRST PART of this discussion of industrial floors by Mr. Ytterberg appeared in the February issue, page 55. It dealt with floors constructed monolithically. A rereading of it will be helpful as an introduction to the discussion of concrete toppings given here.

Part 2. Concrete toppings

A concrete topping, correctly installed, is a surface that is abrasion and shock resistant, practically impervious, smooth, non-dusting, easy to clean and attractive. It is the best floor surface available where these characteristics—either singly or in combination—are required.

But all toppings are not alike; there is a wide range in quality. One method of judging quality is by compressive strength because, in concrete, compressive strength is an indicator of abrasion resistance. Since toppings can range from a low average of 4,000 to 5,000 psi to a high average of 8,000 to 10,000 psi, there is a significant potential variation in quality. The difference results from installation techniques, materials, workmanship, and supervision.

The bulk of this article deals with installation techniques and materials. First, however, it is in order to say something about the necessity for good workmanship and supervision. These two things are intangibles in the sense that they are difficult to define and measure. But they are so essential that without them installation techniques and materials are worthless. Good workmen, men who are willing to expend the necessary energy and to pay attention to detail, must be selected and thoroughly trained. These steps are important because it is next to impossible to watch each man throughout the course of a job no matter how small it may be. Therefore the workmen must take pride in a job well done. However supervision is also necessary because only one man can be responsible for certain procedures, such as the timing of specific operations and the acceptance or rejection of materials.

The procedure outlined here may seem unnecessarily laborious and meticulous. However, there are two valid reasons for its use. One is practical: it has been successful since 1916. The other reason is scientific: it is in conformity with the water-cement-ratio law.

Knowledge of the water-cement ratio was developed in 1917 by Prof. Duff A. Abrams, F. ASCE, then with the Lewis Institute. Simply stated, it is that "The strength of a concrete mixture depends on the quantity of mixing water used in the batch, expressed as a ratio to the volume of cement, *so long as the concrete is workable and the aggregates are clean and structurally sound.* The strength of the concrete decreases as the water ratio increases." (From Bulletin 9, Structural Materials Research Laboratory, Lewis Institute, Chicago, "Quantities of Materials for Concrete.") Some people misread this statement and conclude that a low water-cement ratio, of itself, makes for a high-strength floor. But it should be noted that three things are involved in the law: (1) workability; (2) a water-cement ratio approaching that which is theoretically correct, and (3) good aggregate.

The theoretically minimum ratio of water to cement is a low one, about 2.8 gal per sack of cement to achieve hydration. Hydration is the chemical reaction that takes place when water and cement are combined. The end result is the cohesive substance that holds the aggregate in place.

If, however, a water-cement ratio as low as this were used in the initial mix, it would be so stiff as to be unworkable. It would be impossible to place, screed and compact it, and because of the loss of workability the benefits of the low water-cement ratio could not be realized. Moreover, the void content of the finished topping would be so large as to reduce the compressive strength and increase permeability. On the other hand, if a sufficiently large quantity of water is used to obtain workability and if that water is left in the mix, the excess water will become entrapped on the under side of the coarse aggregate, preventing an adequate bond between the cement paste and the aggregate. To get around this dilemma, workability is achieved by an initial water content of about 5 gal per sack of cement, including the water content of the aggregate.

When there is no longer any need for workability—that is, after Step 5, placing—the water needed for workability is removed by the Absorption Process [R]. This reduces the water content so that after curing the topping contains only about 3.5 gal per sack, or to within 0.7 gal of the theoretical minimum amount of water.

The effect of the installation procedure alone on the finished floor can be

TABLE I. Comparison of results achieved with various mixes

Values given in percentages, using Absorption Process mix as a base of 100

Mix	Voids	Absorption Ability	Cumulative Abrasion Loss 6 Min.	Flexural Strength	Shrinkage
1. Absorption Process mix—excess water removed immediately after screeding to achieve zero slump*	100	100	100	100	100
2. Wet mix (6-in. slump, no water extracted, no tamping)	139	141	220	83	136
3. Medium-dry mix (tamped)	147	152	170	89	169
4. Dry mix (tamped)	140	139	140	93	152

*This means that the mix supports the weight of a man without indentation

NOTE: Normal job practices were followed in placing the various mixes. But laboratory tests cannot duplicate field conditions. Under field conditions the percentage spreads would be much greater, principally because of the workmanship factor.

[R] Registered trade name.

seen from Table I. In the mixes employed, only the highest quality of materials and the most expert workmanship were used. The differences were in the techniques utilized to place the mix. This chart clearly demonstrates the importance of technique.

A topping may be installed integrally or deferred. An integral topping is installed immediately after the base slab has been poured and screeded. A deferred topping is installed after the base slab has set. The latter type is preferred because it is possible to achieve better control of the water-cement ratio and because in new construction the base slab takes the brunt of the heavy construction and any damage to the surface is usually unimportant since it will be covered by the topping. What is described below is the Absorption Process concrete topping, a deferred topping that is about ¾ in. in depth.

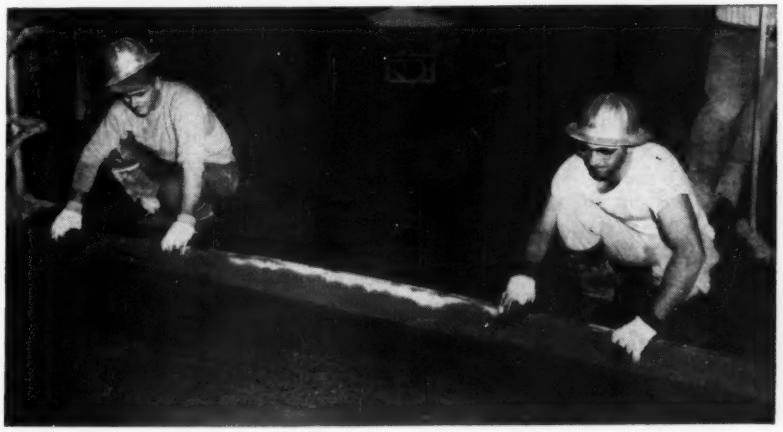
In addition to the details listed below, most of the procedures covered in steps one through six in the previous article on monolithic work are also pertinent here, because a topping cannot be trouble-free if installed on a base that has been inadequately designed or improperly installed.

1. Initial preparation of slab for adhesion. The topping must be bonded to the base slab; otherwise it will crack when loads are run over it. Wire brooming of the base slab at the time it is poured is the first step necessary to achieve mechanical bond. A second brooming is carried out later when the laitance clinging to the coarse aggregate will brush off and show clean stone. If this second brooming does not reveal clean stone, then a third brooming is required. The slab must have a rough texture for bond, but partially exposed aggregate must not be loose. The topping may be installed up to several months after the slab has been poured. The area to be topped must be thoroughly cleaned, and all mortar, concrete, paint, oil, grease, mud, clay or other foreign material from construction must be removed.

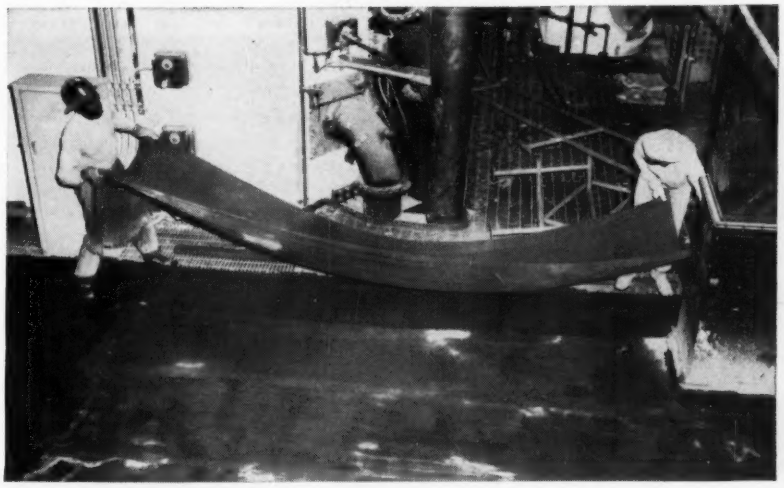
2. Setting screeds. Before the topping is installed, screeds must be set in place. This is a meticulous operation because if the screeds are not accurately placed, it will be impossible to produce a uniformly level floor. This is one of the many features of the work that can be cited to demonstrate the importance of workmanship. Screeds are set in pads of concrete either by using a straight-edge and a spirit level or by a surveyor's level and rod.

3. Final preparation of slab for adhesion. The slab must be saturated 24 hours before the topping is to be

1. Grout is thoroughly worked into base slab.



2. Topping mix is screeded carefully. Note how wet the mix is at this point.



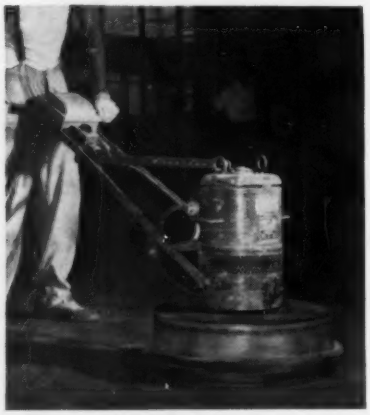
3. Absorption blankets are placed on top of freshly poured and screeded wet mix. Drier material is then spread on top of the blankets and left until job superintendent orders their removal.

4. When drier material is removed, topping is stiff enough to support the weight of a man without indentation.

poured to prevent the slab from drawing much water from the topping while it is curing. A scrub-in coat of cement grout is then applied. Grout is the adhesive agent that bonds the topping to the base slab. The mixture must have a creamy consistency and be worked into the slab with wire brooms.

4. Batching. Each cubic yard of topping mix contains a full cubic yard of coarse aggregate. This volume of stone will have a void content of approximately 40 to 50 percent. Practically all these voids will be filled by fine aggregate and the remaining voids will be filled by the cement-water paste. Both fine aggregate and cement paste must be uniformly distributed to achieve equal strength throughout the depth of the topping. Thus voids in the finished topping are filled; this statement is borne out by the fact that the topping is almost impervious.

To place this amount of solid material in one cubic yard of concrete, maximum densification procedures are mandatory and both coarse and fine aggregate must be properly graded.



5. Mechanical compaction then begins. Float, shown here, is followed by mechanical troweling.

The aggregate used is a basaltic or granitic rock that has been tested for hardness, toughness and soundness because these qualities will add to the wear resistance of the topping. As a minimum, aggregate must conform to ASTM specification C33, with coarse aggregate meeting the No. 8 grading limits of ASTM D448. Aggregate should not be considered merely as a filler that is put into concrete for reasons of economy. Aggregate contributes a definite quality of abrasion resistance and strength. Proof of this is the fact that a cement-water mix by itself will never reach strengths of 8,000 to 10,000 psi whereas the material produced by the technique discussed here will reach these strengths.

This high stone content means that the rock will be uniformly distributed throughout the topping—in fact, the coarse aggregate will come right up to the surface and bear its share of abrasion from the start. Because of the workmanship, this aggregate will not be visible, except on very close inspection. Because of the high stone content it is readily understandable that difficulty could be encountered in placing each batch in a specific area because of a loss of workability.

To achieve workability, about 5 gal of water per sack of cement is used with about 12 sacks of cement per cubic yard. This large quantity of cement not only increases workability but makes the cement binder significantly stronger. This relatively wet mix assures workability and complete saturation of all cement particles, but slump must not exceed 8 in., otherwise segregation will occur and excessive amounts of cement and fine aggregate will float to the surface where they will lower the abrasion resistance of the topping. The whole effort is to get workability but no segregation. Batches should be mixed for at least 1½ min., counting from the time all the solid materials are in the drum.

5. Placing. Excess water and grout puddles on the base slab must be swept away before the mix is poured. In the process the grout needed for adhesion must not be removed. The topping mix must be spread as it is discharged from the buggies because if the mix is dumped in one pile, gravity will cause segregation. At corners and along joints, the topping mix should be puddled to release entrapped air and improve bond.

6. Hydraulic densification. The qualities of a good topping, which were enumerated in the opening paragraph of this article, are a direct result of density. Therefore toppings must be as dense as possible, that is, they must have a minimum void content. All water in excess of that needed for hydration must be removed. Likewise, entrapped air must be removed.

The first densification step in our procedure is our Absorption Process. Burlap blankets are placed on the topping immediately after it has been screeded. A drier material is then spread on the blankets. This drier draws up virtually all the water in the mix which is in excess of the amount needed for maximum strength, but which up to this point was needed for workability. In addition to its densifying effect, this procedure preshrinks the mass and thereby minimizes the possibility of crazing, checking or cracking of the surface—dangers to which a wetter mix is inherently subject. This is simply because the excess water will evaporate and evaporation will either create voids or else cause considerable shrinkage, setting up stresses that are relieved by cracking.

When the water that was needed for workability has been absorbed, the blanket and the drier are removed. The exact amount of time needed for this operation is variable and success in this phase of the process as well as in the other phases depends more on a supervisor's experienced eye than on any formal time schedule, which would have to take into account such variables as temperature and humidity. However, when the blankets are removed, the mix is capable of supporting the weight of a man without identation and the water content is about 3.5 gal per sack of cement. This process densifies the topping, shrinking it perhaps ⅛ in.

7. Mechanical densification. The first mechanical step in densification is power floating, which appreciably increases the density because of the weight and action of the machine. (Our machines weigh up to 625 lb and have an area of about 3 sq ft.) Floating also levels out the surface so that it can be worked by smoother tools (trowels). Too much floating will bring fines to the surface, resulting in an inferior floor. The maximum value of floating cannot be achieved unless the topping is dried out as much as possible since the object is not to remove water (although some is squeezed out) but to further compact the topping.

Machine troweling is the final step in mechanical densification and also the first step in smoothing operations. Machine troweling is not started until whatever moisture film was brought up by floating has evaporated. Several passes, at proper time intervals, are required. (See below for the impor-

tance of timing.) However, all troweling cannot be done by machine because the texture of the floor toward the end of the operation will not be uniform, and different textures require different troweling procedures, to which a machine cannot be adapted.

8. Hand troweling. Hand troweling is the final step in densification. It is primarily a densification step—the surface smoothness and shine produced are a result of densification. Therefore hand troweling must be "hard," that is, the men must put their weight onto the trowel. It is not enough merely to pull the blade across the floor. Downward pressure at the proper blade angle must be exerted at all times. Experienced men are mandatory for this operation from the points of view of stamina required and ability to see how different areas of the floor are setting and to adjust the troweling technique to the particular stage of cement set.

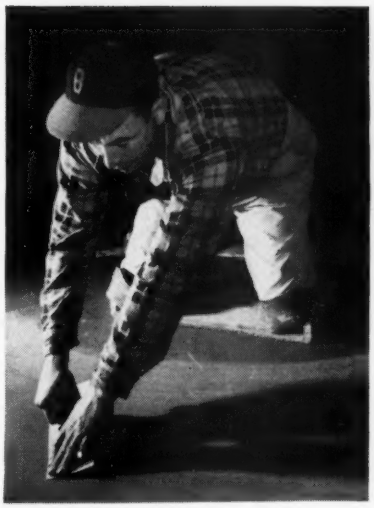
Troweling is not a continuous operation and the number of passes do not guarantee a properly finished floor. This is because the timing of each pass is critical since the cement must be at a certain phase of set to benefit from troweling. If the passes are made too soon, maximum compaction will not occur and the structure of the paste will be needlessly disturbed. If the passes are made too late, again maximum compaction cannot be achieved because the cement set has progressed too far.

What happens is that each pass partially closes the surface structure of the cement-water paste. But the paste has a tendency to "open up" slightly after each pass. This tendency is lessened after each pass until—with proper timing—the surface is completely compacted and smoothed just as the cement sets.

The purpose of the last troweling is to burnish the surface. As the trowel moves over the surface it must ring and the surface must shine. However, "ringing" of itself is meaningless as an indicator that the floor has been properly troweled or installed.

The timing of each pass is determined by the superintendent or finisher foreman. His decision is based not so much on specific observable facts as on judgment based on experience. The entire troweling operation might take up to 9 hours in warm weather and up to 18 hours in cold weather because concrete set is retarded by lower temperatures.

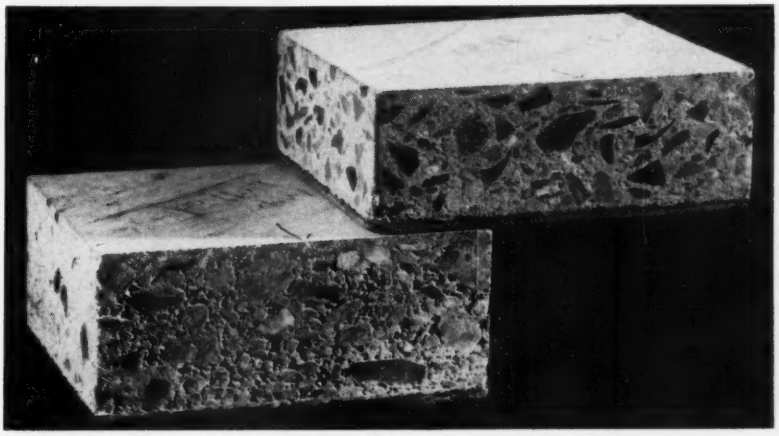
The extra abrasion resistance imparted to a floor by proper and well-timed troweling was indicated by a test which showed that by extending troweling with from two to four passes, abrasion resistance was increased 67 percent. Obviously, maximum hand troweling is well worth the effort to increase abrasion resistance by such a large percentage. This does not mean that four trowelings are optimum. Sometimes it might be, as in the laboratory test cited above, but in the field more passes are almost always required.



6. Extensive hand troweling proceeds until all pores in the concrete have been closed.

7. Floor is cured for at least 10 days during which time the surface must be kept wet.

9. Curing. Curing protects the floor during hydration and supplies whatever extra water is needed. This step is begun shortly after the final troweling. Waterproof paper is laid over the floor and water is flushed under the paper as often as necessary. Our mixes have a very high cement content, and when the cement sets an unusually large amount of heat is generated. Therefore a large amount of water could be lost as a result of this heat generation. Water must either be replenished or its loss minimized. This follows another precept of Professor Abrams, to "allow the concrete to have as much water as possible during the period of curing." (From Bulletin 2, Structural Materials Research Laboratory, Lewis Institute, Chicago, "Effect of Cure Condition on the Wear and Strength of Concrete.") At normal temperatures, the curing period lasts at least 10 days. The topping should always be protected from freezing and should be kept at a temperature of not less than 50 deg F for the entire curing period.



8. Samples cut from experimental panels illustrate differences between an Absorption Process topping (at right) and a dry-mix topping. Quantity of mix was such that the absolute volume of solids per square foot of floor was the same for both mixes. Sample at left is 1½ in. thick, that at right, 1 in., indicating lower void content.

The professional engineer as an employee

Much has been written and said about professional development in the engineering field, a great deal of it focused on the attitude of the employer. Certainly this is important, but equally important if not more so, is the attitude of the employee towards professional development. There are many aspects of professional development which the employee must consider seriously.

It is clear from a variety of definitions that the basic ingredients or criteria of the professional person include formal academic training, usually of some length and in great detail, a willingness to work to advance his profession, and the ability to meet required standards of practice. To these must of course be added the attributes that all professional people should have, such as individual initiative, judgment and discretion, a sense of responsibility and ethical conduct. The four aspects of professional development to be discussed here are professional affiliations, registration, communication, and leadership in public life.

Professional affiliations

An important part of professional development is the interest taken in professional and technical organizations, as shown not only by joining them but also by actively participating in their activities. The public spirited activities of many societies and the services they render to their members are impressive—for example, those rendered by our own American Society of Civil Engineers. There are many reasons for the existence of such professional societies; however a discussion of them is beyond the scope of this article. Of importance here is the fact that the public has somehow come to feel, and with good reason, that the more competent people tend to affiliate themselves with others of their calling; that such organizations have standards, formal or informal, which enhance professional service to the public; and that such affiliations make it possible for members to keep up with the latest developments in their professions. These are all valid, positive, and attractive reasons for joining such professional organizations.

Permit me to specify some activities of professional organizations that are enhancing our professional status and that should be a stimulus to joining and participating in the activities of professional and technical societies.

In my own field of sanitary engineering we have seen in the past few years the creation of the American Sanitary Engineering Intersociety Board. This board certifies the professional competency of sanitary engineers to meet the high standards that have been established. These high standards include professional registration, a degree in engineering, eight years of professional experience, and responsible charge in the field of sanitary engineering. It is to be hoped that engineers certified by the American Sanitary Engineer Intersociety Board will be given recognition similar to that accorded to those who are board-certified in the medical profession.

The American Society of Civil Engineers, through its Committee on Engineers in Public Practice, has been active in the review of legislation and other matters of interest to this professional group. The Committee has concerned itself with: (1) giving certificates of commendation to public agencies; (2) encouraging the active participation of engineering employees in Society affairs; (3) ASCE's position with respect to the appointment of non-engineers to positions in the Federal Government that are actually engineering positions or that require an engineering background; (4) revisions in the Code of Ethics; and (5) the position of the Society with respect to "Consultants and Government Work." The Committee has also concerned itself with proposals for salary increases which have been advanced at various levels of government. At the local level, the Local Sections of ASCE have been active in furthering such aims as these.

The National Society of Professional Engineers has done a great deal in connection with Functional Sections. The Functional Sections for Engineers in Government Practice have reviewed legislation of interest to the engineer in public practice and have been working with Congressional committees on the development of legislation to reinstate the professional salary series and to provide pay flexibility. These committees have also worked with the Functional Sections for the Engineer in Private Practice in developing joint statements on the use of consultants on government projects. The New York City Chapter has done a great deal on the question of unionization. Recently a subcommittee of the National Functional Section for Engineers in Public Practice has been set up to consider the problems of engineers in the uniformed services. All these activities are valid and representative reasons for joining and participating in the activities of professional and technical organizations.

Importance of registration

Registration is coming to be regarded as an important mark of professional status. The completion of certain academic requirements does not of itself entitle the engineer to lasting professional recognition. Just as the doctor and the lawyer must meet certain standards and comply with licensing procedures, so should the engineer before he is allowed to practice engineering. Registration is being recognized increasingly by professional and technical organizations and employers.

The American Sanitary Engineering Intersociety Board has a requirement for registration. The comparatively new Fellow membership grade in the American Society of Civil Engineers requires registration. The Civil Service Commission in Washington has given recognition to registration in the employment of engineers below the grade of GS-12. Also, as a result of the activities of ASCE and NSPE, greater attention has been focused on the registration of engineers in government and in the uniformed services. We should all strive to encourage our professional colleagues to register as professional engineers in a state or in the District of Columbia. In my opinion, this is one of the important steps towards unity. At least it will give us a common denominator on which to build.

It is worth noting that industry, which has always appraised the engineer strictly in terms of whether or not he can "produce," responded to a survey conducted by the Los Angeles Chamber of Commerce with some pointed observations on the desirabil-

FRANK A. BUTRICO, F. ASCE
Chief, Office Engineering Resources Program
U.S. Public Health Service, Washington, D.C.

ity of enhanced professional status. It was the consensus of leading business-industry representatives that "industrial executives should urge the professional legal registration of all qualified engineering personnel. Legal registration gives added professional status to the engineer." Registration is an important obligation of every professional engineer.

Ability to communicate

Next, let us consider communication, one aspect of which is the writing of technical articles. Most of us fall completely flat when it comes to this phase of professional activity. Although a survey of technical writing by engineers stated that "most engineering executives do not consider articles and papers a regular responsibility of engineers," the industrial executives canvassed by the Los Angeles Chamber of Commerce felt that the "writing of technical papers for publication in local trade and professional periodicals should be recognized as an important part of an engineer's professional development."

If these opinions sound a little like double-talk, the reactions of engineers themselves are no clearer. Most engineers do not consider the preparation of technical articles and papers a basic phase of their professional life, although they feel responsible for keeping abreast of technical developments as reported by others in their field. But who is left among the technically competent if no one wants to write? The attitude of "let George do it" is not worthy of a professional engineer.

Professional literature is a major part of the life blood of engineering knowledge and development. Without this literature and the ideas it brings, the engineer is little more than a first-rate mechanic performing routine chores. If some of us are unhappy about the level of excellence of some journals, it may be that we have only ourselves to blame, because by default we have permitted a handful of engineers, who want to and can write, to take over the pages issue after issue. Writing should be considered one of the obligations of the professional engineer.

In addition to writing for his own professional group, the engineer must train himself to write for the lay public. Recently in Cincinnati I heard a talk by a newspaper man, Mr. Lynch of the *Milwaukee Journal*. It was entitled "Do They Dig You Daddy-O or Are You Way Out?" Of course this is the lingo used by beatniks as a barrier to set themselves apart from outsiders. Unfortunately, scientific and technical people are generally guilty of the same attitude. As Mr. Lynch said, "It is a form of snobbishness which we cannot afford."

As professional people we write technical papers and present them at technical meetings to a technical audience that already knows a great deal about the subject. This is fine but unfortunately for us as a professional group, we carry the same jargon outside and use it in addressing laymen. Perhaps we do it to impress people, but it certainly does not influence them. Recently I heard one of my colleagues refer to radioactive materials in addressing a lay group. He kept mentioning LD-50. Probably very few of those who heard him knew that LD-50 is the expression used to mean a dose of radiation that is lethal to 50 percent of the population. If the public does not understand our message, it is not going to accord us the status we seek, nor will it support our projects.

Lastly, there is need in our profession for engineer-statesmen who can help influence public policy. The engineer is very actively involved in the technological advances of our modern society. In fact, the preeminence our country has attained throughout the world in technology is due in large measure to the professional engineer.

The engineer and public policy

The question we want to ask ourselves is how much influence the engineer has in public-policy decisions involving technical projects. How can the engineer make his views known? The answer is that we must keep pace with the changing times and avoid setting ourselves apart by working only at the professional level. Engineers—at least those with the ability for it—must consider additional training and be willing to work in managerial and administrative positions so that they can take a larger part in shaping public policy. Recently Dr. James R. Killian of M.I.T. wrote:

"We need more scientists and engineers whose education and interests are sufficiently broad to permit them to take a greater part in shaping public policy and in evolving our social strategy. We need statesmen-scientists and statesmen-engineers—men who become molders of opinion and public leaders, who make a vital contribution to the common account because they are first of all scientists and engineers and possess the insight and understanding of their specialities, but who also have that broad scope which makes them effective in public life. There is a great shortage of men and women with adequate scientific understanding who can be, and are willing to try to be, effective in the political and policy-making area."

This subject was touched on by Governor George D. Clyde of Utah, in his article in the August 1960 issue of CIVIL ENGINEERING, in which he stated that "Americans have come to regard the professional engineer as a man set apart from politics." He went on to quote from a Rockefeller Foundation report that "The conduct of government depends heavily on the talents of the economist, the agronomist, the engineer, the public health officer, and other experts. . . . The increase in specialization in our society demands more technically trained people at policy-making levels."

Professional responsibility

The professional engineer has a major responsibility for his own professional development. No matter how much stimulus is provided from other sources, the status the individual engineer attains depends for the most part on his own efforts. Some of this effort must be devoted to advancing the profession and strengthening professional and technical organizations that can speak and act in behalf of all professional engineers.

(This article is based on Mr. Butrico's paper presented at the ASCE Boston Convention, before the session of the Committee on Engineers in Public Practice of the ASCE Department of Conditions of Practice.)

THE READERS WRITE

A "respect for complexity" versus "plain horse sense

TO THE EDITOR: For more years than I care to remember I've been irked by the comment, "Engineering is just plain horse sense," and never have I been able to come up with a reply that was both polite and telling enough to refute it. Needless to say, I've never been able to equate the lessons learned in my classes in civil engineering with the nutrient values of oats in a nose bag.

Our new Secretary of State, Dean Rusk, has now provided the perfect answer to this old saw. His statement, as quoted in *Time* magazine for December 26, 1960, was:

"A respect for complexity is the beginning of wisdom."

Perhaps some national concern can be prevailed upon to print Dean Rusk's words as a form of advertising (suitable for framing) so that every engineer can have a copy to hang in his office. The boost to the ego would be incalculable.

JAMES W. DARLING, F. ASCE
Consulting Engineer

Agana, Guam

Deserved praise for a great engineer

TO THE EDITOR: I very much appreciate the fine tribute to my deceased husband, Joseph Franz, in the article, "Engineers Do Appreciate Culture" (Jan. issue p. 82). Mr. M. D. Morris, the author, must have spent much time and trouble in securing the information on my husband's work in designing and building the Tanglewood Music Shed at Stockbridge, Mass. This was a great challenge, involving much that could mean failure or success.

When Serge Koussevitzky walked

Other solutions for footings eccentrically loaded

TO THE EDITOR: The graphic solution for eccentrically loaded footings presented by Professor Knott in the January issue, p. 70, can also be obtained by directly utilizing the kern points as follows:

1. Compute the average pressure P/A

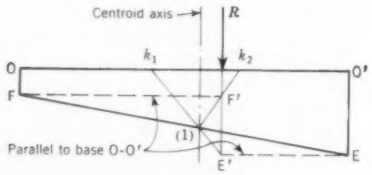


FIG. 1.

and plot to scale on the centroid axis. Point (1) is established.

2. Locate kern points k_1 and k_2 by the formula, $k=I/AC$, in which k=kern distance; I=moment of inertia; and C=extreme fiber distance from centroid axis on the opposite side where k is required.

3. Draw line through k_1 and (1) intersecting R at E'. The ordinate of point E' is the pressure at point O'.

4. Establish point F' similar to Step 3.

5. Draw line EF, which represents the soil pressure and should pass through point (1). This provides an automatic check.

Note that this is a general solution applicable to footings of any shape provided the kern distances are known. Readers interested in this topic should refer to *Continuous Frames of Reinforced Concrete*, by Cross and Morgan, p. 130.

F. C. CHAN, M. ASCE
Structural Engr., Reid, Rockwell, Banwell & Tarics

San Francisco, Calif.

TO THE EDITOR: There is another method for determining the location of the resultant force of any linear pressure distribution. This method can also be used in reverse, that is, to determine a linear pressure distribution given a base and resultant location.

It is shown for all compression or tension, and for part compression and part tension in Figs. 1 and 2 respectively. The

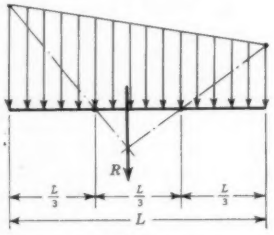


FIG. 1

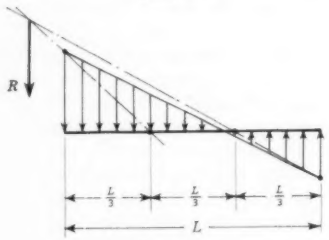


FIG. 2

proof of the correctness of this method can be derived easily from geometry.

MICHAEL A. JORDAN, A.M. ASCE
Civil Engr., H. M. O'Neil Co.
Civil and Structural Engrs.

Oakland, Calif.

TO THE EDITOR: The article by Professor Knott was most interesting. While several methods of solving this problem are available, I believe that the following construction is the simplest means of obtaining the required trapezoid.

Consider that a member of a rectangular cross-section is subjected to an eccentric longitudinal load P. In the accompanying drawing, Fig. 1, let OO' represent the depth of the member with respect to bending, and Q the point of application of the load.

Locate M and T, the mid-point and

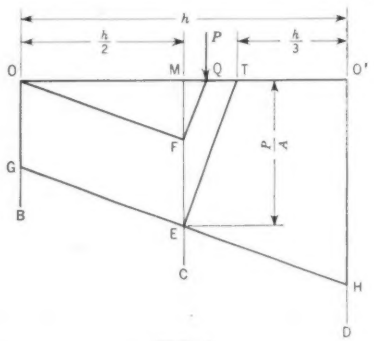


FIG. 1

third point, respectively, of OO'. Draw OB, MC, *and* $O'D$, each perpendicular to OO'. Make $ME = P/A$, where A denotes cross-sectional area of member.

Draw line TE, and draw a line through Q parallel to TE, intersecting ME at F. Draw OF, and draw a line through E parallel to OF, intersecting OB at G and $O'D$ at H.

Trapezoid $OO'HG$ is the stress diagram of the member, the stress varying uniformly from OG at one end to $O'H$ at the other.

If the applied load lies outside the middle third of the section (that is, if Q lies to the right of T), G falls above O, signifying that the stress at that end is negative. A reversal of the foregoing construction enables us to locate the centroidal axis of a given trapezoid.

MAX KURTZ
Consulting Engineer

Brooklyn, N. Y.

around the colonnade to listen to the music that was coming from his musicians on the stage, all he could say was "It's marvelous, it's marvelous!" Thus the accomplishment of Joseph Franz was pronounced a success.

My husband, a registered professional engineer, was very versatile. Although he did some civil engineering, his work was mostly in the electrical field. There his accomplishments were many, including the first outdoor hydroelectric plant, which received world-wide recognition. He also built the Laurel Hill Bridge and the Jacobs Pillow Dance Theater.

EMILIA R. FRANZ

Stockbridge, Mass.

Questions extensive research in engineering schools

TO THE EDITOR: The Report of the 1960 Conference on Civil Engineering Education at the University of Michigan (January issue pp. 56-59) verifies the fact that registration in undergraduate civil engineering schools is falling. There is no corresponding decrease in the activities of practicing civil engineers. Conclusions and resolutions from the Conference are questionable without the balancing ideas of practicing engineers.

Are our engineering educators trying to produce civil engineers or something that the practicing engineer cannot recognize? Such educators appear to be following two interrelated trends that lead them away from their fundamental duty. One is the requirement for higher degrees for engineering educators, the other the conduct of research at educational institutions.

The requirement for higher degrees cannot be questioned if these degrees mean advanced knowledge in civil engineering as practiced. This, however, presents difficulties as there are, and always will be, many facets of practice that cannot be taught in the educational system as at present constituted.

Engineering educators insist on research as the basis for granting advanced degrees. There is reason to question the value of extensive research in an engineering school. The conduct of research at educational institutions is a broad subject and is not solely an engineering problem. Civil engineers should be reminded that the U. S. military service schools,

Square and cube roots by abacus or any digital computing device

TO THE EDITOR: By way of complementing the method of successive approximations for extracting square and cube roots by S. G. Roeblad, F. ASCE, in the December 1960 issue, p. 72, the writer recommends, instead, exact procedures known as the "half-square-root" and the "third-cube-root" methods devised by ancient Chinese mathematicians for use on the abacus. These methods can well be adapted to any digital computing device. Their theory and operation are well illustrated by considering the expansion and factoring of the square and cube of a polynomial.

Half-square-root method

Let $(a + b + c + \ldots)$ be the square root of any number N, using binomial, trinomial, quadrinomial, etc., respectively for roots of two, three, four or more digits. For a quadrinomial we have

$$N = (a + b + c + d)^2$$

After expanding and factoring, there results

$$(a+b+c+d)^2 = 2\left[\frac{a^2}{2} + \left(a+\frac{b}{2}\right)b + \left(a+b+\frac{c}{2}\right)c + \left(a+b+c+\frac{d}{2}\right)d\right]$$

where the sum within brackets on the right-hand side is the "half-square" and that on the left the "root," and hence the name of the method. Its numerical operation follows directly.

For example, if the square root of 622,521 is desired, a trinomial of the first three terms will suffice. Write

	$N = 62,25,21$	suggesting $a = 700$
$-a^2$	$-\ 49\ 00\ 00$	
$\div 2$	$2\ )\ 13\ 25\ 21$	
	$6\ 62\ 60.5$	$\div \left(a+\frac{b}{2}\right) \gtrsim b = 80$
$-\left(a+\frac{b}{2}\right)b$	$-\ 5\ 92\ 00.0$	
	$70\ 60.5$	$\div \left(a+b+\frac{c}{2}\right) = c = 9$
$-\left(a+b+\frac{c}{2}\right)c$	$-\ 70\ 60.5$	$\therefore a+b+c = 789$
	0	

The square root is 789.

Note that following the first half remainder, 66260.5, the process is to divide it by $\left(a+\frac{b}{2}\right) = \left(700+\frac{b}{2}\right)$ to get the maximum possible integer b as an integral multiple of 10, in this instance such that $b\left(700+\frac{b}{2}\right) \lesssim 66260.5$, resulting in $b = 80$ in this case. The same explanation applies to similar processes after other remainders.

Third-cube-root method

To extract cube roots requires transformation of binomial, trinomial, quadrinomial, etc., expansion respectively for cube roots of two, three, four or more digits. The trinomial expansion of a three-digit root, for example, may be transformed into the following form:

$$N = (a+b+c)^3 = 3\left\{\frac{a^3}{3} + a\left(a+b+\frac{b^2}{3a}\right)b + (a+b)\left[a+b+c+\frac{c^2}{3(a+b)}\right]c\right\}$$

where the sum within brackets on the right-hand side is the "third cube" and that on the left the "root," and hence the name of the method. For a root of more than three digits, add terms accordingly; likewise for an infinite root to the desired number of digits.

In the case of a two-digit root, the first two terms only will suffice. As an illustration, to extract the cube root of

	$N = 704,969$	suggesting $a = 80$
$-a^3$	$-\ 512\ 000$	
$\div 3a$	$240)192\ 969$	
		$804\frac{3}{60} \div \left(a+b+\frac{b^2}{3a}\right) = b = 9$
$-\left(a+b+\frac{b^2}{3a}\right)b$	$-804\frac{3}{60}$	
	0	$\therefore a+b = 89$

The cube root is 89.

The numerical technique can be adapted to any type of computing machine.

Mobile, Ala.

SHU-T'IEN LI, F. ASCE
Consulting Engineer

which produce good officers for the Armed Services, do not conduct research and development programs.

When research-minded persons constitute the vast majority of engineering educators, there is little enthusiasm for teaching the practice of civil engineering. A research-centered faculty, concentrating on teaching research-inclined successors, can change completely the concept of civil engineering. The ultimate result will be that functions now considered an integral part of civil engineering practice, including administrative and executive duties, will be separated from it and will be assumed by non-engineers. The title of civil engineer will then be held by a few individuals—more scientists than engineers—who will have very little in common with the civil engineer as we now know him.

The proposed definition of civil engineering as "the fulfillment of human needs through the adaptation and control of the land-water-air-environment," hardly describes the occupation of translating the abstract mysteries of science and mathematics into understandable plans for construction, in which such engineers as the writer have spent their lives.

Can it be that the present viewpoint of leading educators has something to do with the shortage of entering students in civil engineering? Perhaps many students who have the qualities essential for the practice of civil engineering realize that they cannot grasp this other occupation as taught in our engineering schools.

ROBERT C. SHELDON, F. ASCE
(Comdr. USN Ret'd)
Dept. of Civil Eng.
Univ. of North Dakota

Grand Forks, N. Dak.

Locating back publications, another service to members

Such letters as the following show appreciation for the services the Society renders to its members. One of these services that is little publicized is to locate unneeded sets of TRANSACTIONS *for those in search of such sets. The intermediary in this service to get the "have's" and the "have not's" together is Harold T. Larsen, F. ASCE, Manager of Technical Publications, ASCE Headquarters, 33 West 39th Street, New York 18, N. Y.*

TO THE EDITOR: I am happy to enclose my ASCE dues because the services the Society performs for the engineering profession are monumental.

I shall appreciate any information you may have to offer about obtaining a library of TRANSACTIONS. I am told that some who no longer have a need for these publications are willing to dispose of them to members who will give them the appreciation they deserve. I will be grateful for any contacts you can afford me.

N. M. HERNANDEZ, A.M. ASCE
Engineer, East Ghor Canal Authority

Amman, Jordan

A general slope and deflection formula

TO THE EDITOR: In his comments (Feb. 1961, p. 70) on my letter to the editor concerning the conjugate-beam procedure (Nov. 1960, p. 76), Dr. Shu-t'ien Li apparently overlooked the fact that it was a discussion of another method presented previously by Mr. Fickel, and hence limited to the scope of that original paper. (June 1960, p. 70).

With thanks to Dr. Li for his favorable comments, replies to those that are unfavorable are given in the order presented by him.

1. "A long-table explanation for only a special case." Since the table applies to a 20-segment beam of any span length, this should not be considered a special case.

2. "Oversimplified restriction to the particular pattern at mid-span." This was the illustration chosen by the original author, Mr. Fickel, but a beam with 20 different cross-sections might have been analyzed.

3. "Approximate instead of exact." However exact may be the formula, the final result is no more accurate than the given data.

4. "Many one-figure and two-figure tabular values incapable of giving the usual three-figure accuracy." Since the tabular quantities are to be multiplied by $(10)^{-4}$, they are believed to be sufficiently accurate, particularly when this table actually gives four-figure or five-figure accuracy to the final result, which is the summation of these quantities.

5. "Limitation to a 20-ft beam." It should be noted that the discussion applies to a 20-segment beam of any span length, not a 20-ft beam.

6. "Unavoidable additional calculations if the point of deflection sought is off each 1-ft point." Since the deflection curve is extremely flat and varies little from point to point, it is believed that such additional calculations will generally not be needed.

7. "Inapplicability of the table when the stepping point is anywhere else than at mid-span." This point has already been answered above.

8. "Leaving readers without a clue as to how to calculate the deflections at any point, etc." This criticism is certainly justified.

The conjugate-beam and elastic weight methods are identical. Shears give slopes (rotations) and moments give deflections. No other procedure can be as simple, Castigliano's theorems to the contrary notwithstanding. For this special case, Dr. Li's method works smoothly, but it appears impractical for a variable number of steps.

For a beam AB under uniform load divided into n segments of equal length, the value of θ_L (or θ_A) for the mth segment *alone* is,

$$\theta_L = \frac{1}{2}\frac{1}{n^4}\left[m(n-m)^2 - \frac{n}{6} + \frac{m}{4}\right](r_m),$$

where $r_m = I_{min}/I_m$; I_m being the actual I at that section.

Likewise, θ_R (or θ_B) $= \frac{1}{2}\frac{1}{n^4}[(m)^2(n-m) + \frac{n}{12} - \frac{m}{4}](r_m)$.

If $m = 8$ and $n = 20$, then for the 8th segment alone, we have $\theta_L = (10)^{-4}(35.96)$ (r_8); $\theta_R = (10)^{-4}$ (24.00) (r_8).

Referring to the table, we find 35.96 and 24.00 at the proper place for θ_L and θ_R respectively.

Knowing θ_L and θ_R, the deflection coefficients can be obtained very easily. Thus for the 8th segment alone, the deflection coefficient for point 10 (mid-span) $= \theta_R(0.5) = 24.00 \times 0.5 = 12.00$, as shown in the table.

For actual rotations, these quantities are to be multiplied by $(10)^{-4}(r_8)$ (wL^3); for deflection, by $(10)^{-4}(r_8)$ (wL^4).

Concentrated loads can be treated similarly.

T. F. HICKERSON, F. ASCE
Formerly Prof. of Civil Eng.
Univ. of North Carolina

Chapel Hill, N. C.

Power of unions

TO THE EDITOR: It is my opinion that a mass effort to offset the type of legislation favored by unions is long past due. (See letter from H. C. Berry, January issue, p. 69.) Civil engineers, of all people, have been in a position to see this union Frankenstein develop over the years. Yet through cowardice, I think, rather than through lack of concern, they have done little or nothing to oppose it.

The labor-union boss does not hesitate to shake his fist in our faces, or shut down our jobs when it suits his purpose. And he usually gets what he wants. The power of the unions is already almost, if not completely, beyond government control. They have the power to tie up the whole life of the nation. Something must be done to curb it, and now.

In taking a position of leadership in this matter, the engineer is not only standing up for his own rights but he is helping to protect the millions of unorganized individuals who are always the ultimate victims.

H. A. THALIMER, Life Member ASCE

Huntington Park, Calif.

More on tension coefficients

TO THE EDITOR: The article by Profs. Fortey and Krahl on the use of tension coefficients, in the February issue, p. 60, serves to bring a useful tool in the solution of space frameworks to the attention of readers in a very clear manner. The bibliography for this article might be extended by adding *Structural Theory*, by Sutherland and Bowman (4th ed., John Wiley and Sons, 1950), as this book contains a succinct description of the use of tension coefficients.

ANTHONY HOADLEY, F. ASCE
Prof. of Civil Eng.
Union College

Schenectady, N. Y.

ASCE NEWS

New Districts and Zones Committee in Operation

The ASCE Committee on Districts and Zones, appointed by the Board of Direction at its Boston meeting in October 1960, has already met twice to determine basic principles upon which it will work. The committee was charged to report at the earliest possible date with positive recommendations for reallocation of District and Zone boundaries including, if necessary, proposals for amending the Constitution and Bylaws. The initial efforts of the group have been devoted mainly to formulating a sound basic approach to the problem. Out of the two meetings have come the following statement of policy:

"The Bylaws of the American Society of Civil Engineers require the Board of Direction to review and, if deemed desirable, to change the boundaries of Districts and Zones every ten years, on years evenly divisible by ten, or more often if the Board so desires.

"One of the purposes, but by no means the only purpose of this feature, is to maintain reasonable equality in the number of members a Director represents in Board deliberations. Thus the subject does touch on the right of fair and equitable representation which is so sacred in the American tradition. Because of this, the possible adjustment of boundaries of Districts and Zones is a somewhat unwarranted but nevertheless continuing troublesome issue. Regularly constituted committees have grappled with the problem year after year, such that it becomes controversial to a degree perhaps all out of proportion to its real importance. Historically the Society seldom, however, upsets the status quo, but it has devoted considerable time to the subject at some expense to other important matters.

"The Committee on Districts and Zones created by the Board of Direction in October 1960 is a further effort to find a satisfactory solution. This Committee has before it the prolific and exhaustive works of a great many eminently qualified committees who previously have sought a solution. This Committee is specifically licensed by the Board to make recommendations without reference to whether or not such recommendations involve changes in the Constitution, where other committees may have felt that they either did not have the freedom or did not choose to consider solutions which would involve a vote of the membership to implement their recommendations. The Society incurs a very sizable expense in voting on a constitutional change and the Board quite properly seeks to minimize such expense.

"The Committee in beginning its work has adopted a simple and fundamental guiding principle: Any recommended solution of the Districts and Zones issue should be calculated to resolve the problem for as far into the future as is practicable and on a basis which will best promote the welfare and prestige of the Society in the theory of the greatest good for the greatest number, even though this may be in conflict with the more provincial desires of some individual Districts and Zones."

ASCE Past President Mason G. Lockwood is chairman of the Committee on Districts and Zones, which also includes Past President Louis R. Howson, and former Directors Jewell M. Garrelts and Graham P. Willoughby.

Cumulative Index to ASCE Publications

As announced in earlier issues, a three-part index to Proceedings, Transactions, and CIVIL ENGINEERING is now available. The 816-page, 6- by 9-in. cloth-bound book contains a subject and name index for CIVIL ENGINEERING from its inception in 1930 through 1959. For Proceedings, the coverage is from 1950 through 1959, a period in which many papers were not included in Transactions. The index for Transactions covers the years 1935 through 1959.

The list price for this volume is $20. Members of ASCE and public and school libraries are entitled to a 50 percent discount. A coupon to order the Cumulative Index is on page 115.

ASCE Membership as of March 9, 1961

Fellows	11,162
Members	16,452
Associate Members	19,014
Affiliate Members	115
Honorary Members	47
Total	46,790
(March 9, 1960	44,970)

Washington Award Goes To Electrical Engineer

William V. Kahler, a member of the American Institute of Electrical Engineers and president of the Illinois Bell Telephone Company, is the recipient of the Washington Award for 1961. Presentation of the award to Mr. Kahler took place at a dinner meeting of the Western Society of Engineers, held in Chicago on March 2. He was cited "for exceptional leadership in advancement of communication, for distinguished service in civic affairs, and for aid to education and humanity."

The Washington Award is administered by the Western Society of Engineers, on the recommendation of a commission representing the four original Founder Societies. Established in 1916 by the late John Watson Alvord, Hon. M. ASCE, the award is "an honor conferred upon an engineer by fellow engineers for accomplishments which preeminently promote the happiness, comfort, and well-being of humanity." Previous recipients include Orville Wright, Henry Ford, and ASCE Honorary Members Herbert Hoover, Mortimer E. Cooley, Ralph Modjeski, Ambrose Swasey, Charles F. Kettering, and Daniel W. Mead.

Mr. Kahler, a native of Missouri and graduate of the University of Missouri, has spent most of his career with the Bell Telephone Company. He became chief engineer of Illinois Bell in 1938 and was elected president in 1951. During the war he served the government in several capacities including that of director of the Bureau of Construction of the War Production Board.

In his address accepting the Washington Award, Mr. Kahler urged the leading professional engineering societies to volunteer counsel to President Kennedy and Congress in technical assistance programs. He also suggested that retired engineers might be tapped in technical phases of the President's Peace Corps and other foreign aid operations.

Division Doings

Construction Division

The Construction Division, through Executive Secretary Wisely, is asking state boards of engineering examiners for a statement of their policies concerning engineers in the employ of construction contractors. The states are being asked to furnish a statement of current policy and procedure in evaluating construction experience in the various positions of construction contractor employment. These positions would include construction superintendent; project, field, estimating, cost, and materials engineer; purchasing agent, and the like. The Construction Division plans to examine material obtained and suggest action to correct inequities.

For Pipeliners

The February issue of the Pipeline Division Journal is recommended reading for pipeliners concerned with location problems (and who isn't?). This issue carries a series of definitive reports by the Committee on Pipeline Location. Included are reports on:

- As-Built Records
- Engineering Service Agreements
- Duties of the Engineer on Construction
- Reconnaissance

Also included is a report by the Committee on Flotation Studies, which carries up-to-date data on rational design for pipelines across inundated areas.

Sanitary Engineering Division

Continuous concern over the health effects of atmospheric pollutants, as well as the economic loss involved, is spurring the program of the recently organized Research Council on Air Resources Engineering. The Council, which was formed by action of the ASCE Board at the urging of the Sanitary Engineering Division, will operate under the Division.

The Council has announced general categories of study to be undertaken. These include:

- Health effects of atmospheric pollutants
- Urban growth patterns as affected by atmospheric pollutants
- Processes to abate or counteract pollutants
- Instrumentation for analyzing the atmosphere and its pollutants
- Incineration pollutants
- Micro-meteorology, agricultural air management, and closed ecology

After considering inclusion of studies of gasoline engine exhaust pollutants, the Council recognized that extensive work in this area has been completed or is under way.

The objective of the Council is to advance engineering knowledge and practice through stimulating and guiding research in the field of air pollution control and assisting in financing the research.

In its organization stages, the Council cited the direct cost of polluted atmosphere, which runs to at least $10 per capita per year. In some metropolitan areas, where soot, ash, and dust fall are uncontrolled, these costs are much higher. One of the Council's early projects will be to determine such costs with greater accuracy, pointing up specific areas for early abatement procedures. Before long invitations will be sent out to a seminar that will give definition to the various studies that are to be undertaken. Announcement of the scope, time, and place of the conference will be made later.

Officers in the control group of the Council are William T. Ingram, chairman; Albert F. Bush, vice chairman; and William S. Foster, secretary. Others named to the control group are Dwight F. Metzler (as representative of the Sanitary Engineering Division), Ralph C. Graber, Alvin F. Meyer, Jr., and August T. Rosano.

Structural Division

Arrangements are being made for the Second Conference on Fundamental Research in Plain Concrete, to be held at the University of Illinois Conference Center, Allerton Paik, Ill., September 5-8, 1961. The success of the first conference, held in September 1958, has attracted wide attention from persons interested in the field of concrete research, and many requests for a second conference have been received.

The forthcoming conference will be devoted to such topics as Kinetics of Hydration, Rheology of Concrete, Origin and Nature of Strength, Fracture, and Aggregate Reactions. It is expected that the conference will fill a need arising from the interrelationship of the several disciplines involved in concrete research, from the isolation of researchers, and from the lack of other opportunity for synthesizing in many areas of specialization.

ASCE will be represented in the Second Conference by Leo H. Corning. Other sponsoring organizations and their representatives (most of them also members of ASCE) are: American Concrete Institute, Bryant Mather; American Society for Testing Materials, Kenneth B. Woods; Portland Cement Association, Hubert Woods; Reinforced Concrete Council, Gene M. Nordby; and the University of Illinois, Clyde E. Kesler. Representatives of the sponsoring groups will serve on the conference Steering Committee, with Professor Kesler as chairman. Prof. John W. Murdoch, of the University of Illinois, is secretary to the Steering Committee. Support by the National Science Foundation makes the conference possible.

Available facilities at the Conference Center will limit attendance to about 100 persons invited by the Steering Committee. Engineers wishing to attend should write to Prof. Clyde E. Kesler, Department of Theoretical and Applied Mechanics, University of Illinois, Urbana, Ill.

Attending recent meeting of Research Council on Air Resources, set up to study effects of atmospheric pollutants, are (left to right, seated) William Foster, editor, "American City"; Prof. Albert F. Bush, University of California, Los Angeles; Ralph C. Graber, USPHS, Air Pollution Program, Washington, D.C.; William T. Ingram, consulting engineer, New York City; and John J. Baffa, chairman, Sanitary Engineering Division and New York City consulting engineer; Standing is Don P. Reynolds, Assistant Secretary of ASCE.

THE YOUNGER VIEWPOINT

This month's editor is Donald Kowtko, Zone I representative.

Many young engineers, after graduating with B.S. degrees, are hired by large industrial firms which offer them a high salary, more benefits, and greater security than the young engineer could hope to find with, say, a small consulting engineering firm. These large companies are willing to spend from $750 to $1,000 per engineer for recruiting costs alone.

Such companies, realizing that they are "investing in their future," hope to hold these employees as they mature and gain experience until they are finally earning the salaries they are paid. They can afford to do this, whereas small engineering firms cannot indulge in this "luxury."

Some competition in recruiting comes from job openings with the Federal Government, but not very much, I'm afraid.

Salaries higher in industry

The Bureau of Labor Statistics recently released a very comprehensive salary survey* including data on 247,000 engineers employed by 1,600 large firms. One of the more interesting findings of this survey is that engineers employed in industry are substantially ahead of engineers employed by the Federal Government, in terms of salary. . . . This survey more or less duplicates salary survey findings made by the Engineering Manpower Commission of Engineers Joint Council [see page 43]. T. P. Kanninen (of the Division of Wages and Industrial Relations of BLS), who supervised the government survey, points to the major limitation of the EMC survey as being a plot of salary against years since the B.S. degree rather than engineering work levels. The BLS survey plots salary against six carefully defined work levels, which are equivalent to GS-5 through GS-13 Federal grades. A comparison of Federal and industrial salaries for engineers follows:

Grade Level	Industry Average	Gov't. Minimum	Gov't. Maximum
Engineer I (GS-5)	$ 6,371	$ 4,345	$ 5,335
Engineer II (GS-7)	7,241	5,355	6,345
Engineer III (GS-9)	8,411	6,435	7,425
Engineer IV (GS-11)	9,868	7,560	8,860
Engineer V (GS-12)	11,620	8,955	10,255
Engineer VI (GS-13)	14,193	10,635	11,935

With the lure of higher salaries drawing many competent engineers into industry, the Federal Government is forced to rely on more easily satisfied professional talent. The BLS salary survey should supply Congress with enough information to reappraise the federal pay structure in relation to the prevailing rates in industry and improve them.

Recruiting by small companies?

Further, how do small companies handle job applications submitted by engineers not interested in large industrial firms or government employment? The following letter from John Huson, A.M. ASCE, indicates his experience in trying to find a job in the construction field:

"After having graduated from a midwestern university with honors and serving three years in the Civil Engineer Corps of the U. S. Navy, I decided that I would like to work in the construction field. I prepared a résumé and sent it, along with a letter, to about ten of the largest construction organizations in the area in which I was interested in working. I received replies to only two of these letters. I, therefore, visited the local offices of about twenty construction companies. The general attitude I found was that, though many firms would be interested in hiring me in the near future, they were not prepared to hire engineers until specific contracts were obtained. One firm's area supervisor, who did need engineering help, told me that his home office would write me within a week with a definite answer. I have never received any answer. . . .

"Mr. Walsh, of the Illinois Section, has commented that young engineers are being pampered in this matter, and that they expect too much security in seeking employment. There is undoubtedly some truth to this. However, when many construction companies do not even have the courtesy to answer letters or are not in a position to offer to satisfactory applicants definite commitments (either as to original employment or tenure beyond one project), can they expect to interest good young engineers? Possibly, construction companies' poor employment practices have as much to do with influencing young engineers to enter industry, as has industry's aggressive recruiting."

Who needs benefits!

The young engineer just out of college and unmarried normally has few responsibilities and is probably unconcerned about group insurance plans, retirement benefits, and the like which come as part of the neatly wrapped package labelled "fringe benefits" when he starts working for a large industrial firm. However, marriage, children, and a home rapidly bring these inducements into sharper focus very shortly afterward.

Many small companies simply cannot afford the high overhead costs associated with extensive fringe benefit plans. As the young engineer gains experience with the large company and acquires family obligations, he finds it difficult to get a position that pays his old salary plus the fringe benefits to which he has become accustomed with a much smaller firm.

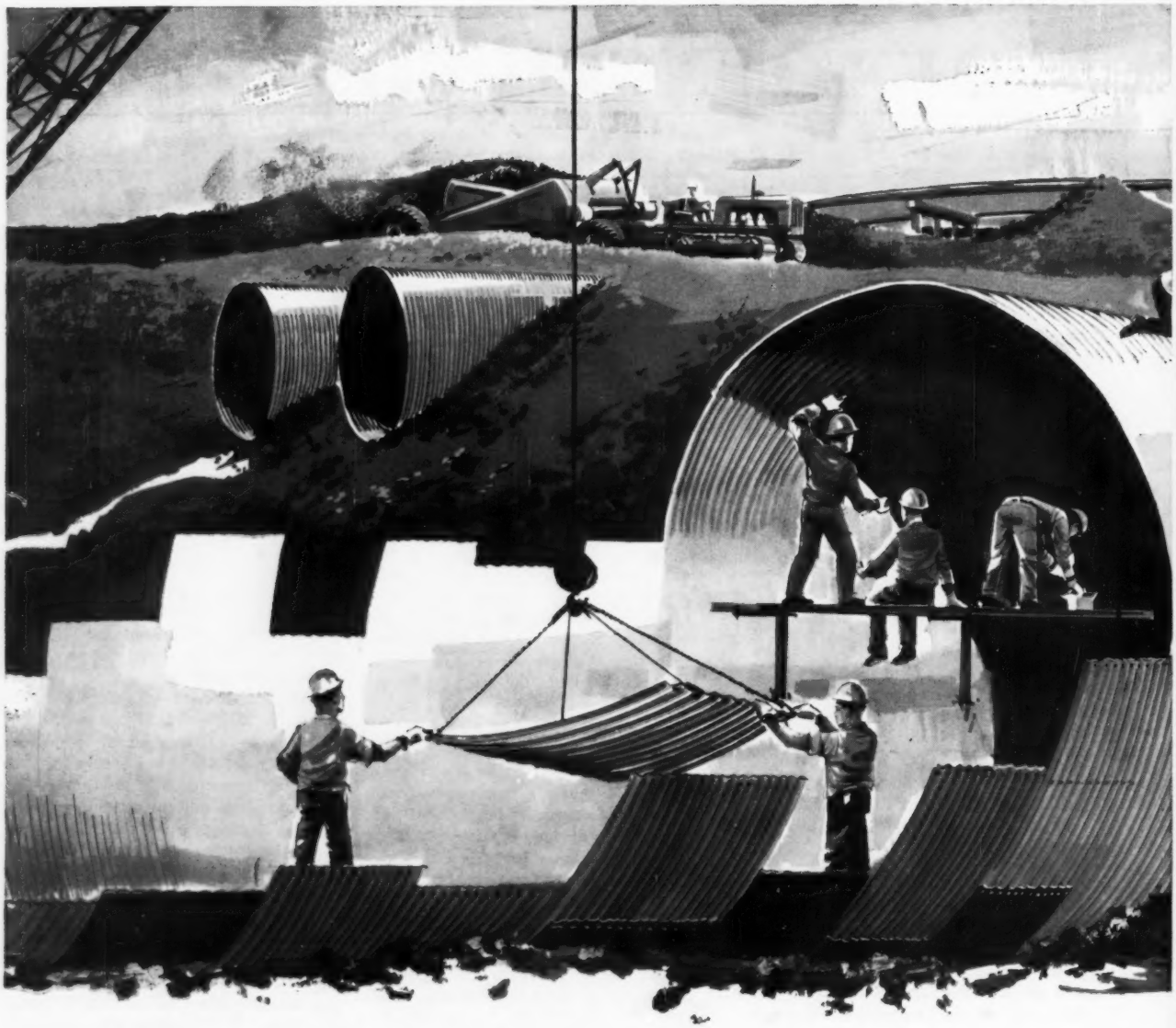
Actually the security required by the engineer, who also happens to be a husband and father, need not be as expensive as one might imagine. Seymour Freed, A.M. ASCE, has done some serious thinking about the new ASCE Group Life Insurance Plan as his letter indicates.

"The ASCE Group Life Insurance Plan offering insurance to members at favorable rates, provides an excellent opportunity for the younger member to utilize his insurance as part of a broader plan which could be called self endowment. An endowment contract consists of decreasing term insurance and increasing investment. The group plan is decreasing term. By investing a predetermined amount regularly in insured institutions, you can provide the increasing investment.

"I have worked out a program costing $600 per year ($100 for the Group Life Insurance and $500 to be deposited in a savings account). The amount to be set aside for annual savings could obviously be more or less, depending upon the individual's ability to save and his needs.

"If a member starts the plan at age 31, he will have immediately created an estate of $24,620 ($24,120 insurance and $500 savings). Assuming a return of 3 percent compounded annually, his estate will decrease slightly each year until he has reached age 45 when it will be $19,650 ($10,350 insurance and $9,300 savings). After that, the estate will gradu-

* BLS Bulletin 1286, "National Survey of Professional, Administrative, Technical and Clerical Pay; Winter 1959-60," is available at 35 cents per copy from the Superintendent of Documents, GPO, Washington 25, D. C.



New design method for Armco pipe

ARMCO DRAINAGE & METAL PRODUCTS, INC.,
4951 Curtis Street, Middletown, Ohio

☐ Send my free copy of "The Corrugated Metal Conduit as a Compression Ring."

☐ Arrange for Armco Sales Engineer in my area to discuss Ring Compression method in detail.

NAME_____ TITLE_____

FIRM_____

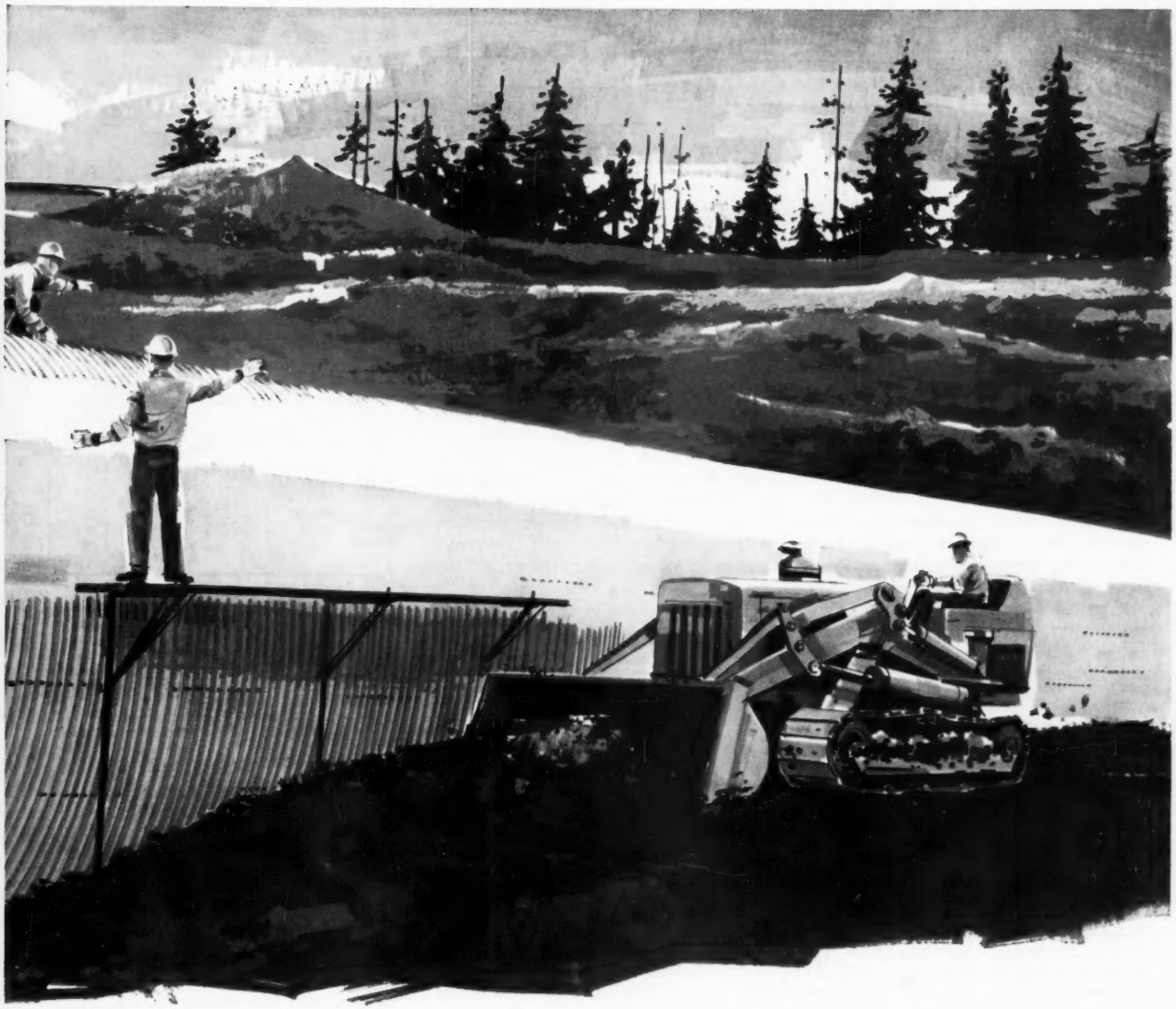
STREET_____

CITY_____ ZONE____ STATE_____

Armco's new Ring Compression formula provides a valuable design tool that is making big news in the engineering-construction world.

Steel — For strength, economy, durability

This new design concept for installing Armco Corrugated Metal Structures provides great economies by reducing metal thicknesses formerly specified for given loading conditions. In addition, it permits use of larger sizes for vehicular grade separation



uses soil structure to cut costs

structures or drainage conduits.

A comprehensive discussion of this new method has been published and is now available in booklet form. It is complimentary, of course. Use the handy coupon to get your copy. Armco Drainage & Metal Products, Inc., 4951 Curtis St., Middletown, Ohio.

ARMCO Drainage & Metal Products

ally increase in value until it reaches $26,940 at age 60 ($3,150 insurance and $23,790 savings) and $32,480 at age 65 ($2,250 insurance and $30,230 savings).

"The savings should be set up in a separate account in a federally insured savings bank or savings and loan association. Do not invest these funds for capital appreciation as they should not fluctuate with the business cycle. Once the amount to be saved has been determined, it is essential to rigidly deposit it every year. . . . For those who say, 'I need a bill each year to remind me of my obligations,' this program is not for you, but you will pay handsomely for the annual billing service."

In summary

Briefly, then, the engineer will probably find it easiest to obtain a job with the Federal Government or large industrial firms, with the latter paying substantially more money. And he may find a rewarding career, in terms of professional development, with one of these job sources. However, the engineer looking to find a career with a smaller firm will probably have to put substantially more effort into locating that position and will have to consider fringe benefits as a legitimate part of his cost of living, which now comes directly out of his pocket.

Scholarship Fund to Honor Albert Haertlein

Former students and admirers of the late Albert Haertlein, Honorary Member of ASCE and dean of the Division of Engineering and Applied Physics at Harvard University, will be interested to hear that a scholarship fund for student aid is being established in his memory. The scholarship was initiated by the Harvard Engineering Society in response to a number of requests that the memory of Dean Haertlein's contributions to the Harvard Engineering School be perpetuated. Dean Haertlein died last June after more than forty years of service to the School. For eighteen years he served the state as a member of the Massachusetts Board of Registration of Professional Engineers. Kenneth Campbell has been appointed chairman of a committee that will raise funds for the scholarship.

Persons wishing to contribute to the Albert Haertlein Scholarship Fund may send their contributions to Reuben Samuels, Treasurer, Albert Haertlein Scholarship Fund, 624 Madison Avenue, New York 22, N.Y.

ASCE ENGINEERING SALARY INDEX

(Prepared Semiannually)

Consulting Firms

CITY	CURRENT	PREVIOUS
Atlanta	1.38	1.21
Baltimore	1.14	1.14
Boston	1.23	1.23
Chicago	1.50	1.49
Denver	1.25	1.25
Houston	1.26	1.26
Kansas City	1.19	1.15
Los Angeles	1.35	1.32
Miami	1.38	1.38
New Orleans	1.22	1.22
New York	1.29	1.29
Pittsburgh	1.07	1.07
Portland (Ore.)	1.28	1.24
San Francisco	1.35	1.34
Seattle	1.13	1.06

Highway Departments

REGION	CURRENT	PREVIOUS
I, New England	1.03	1.03
II, Mid Atlantic	1.15	1.15
III, Mid West	1.26	1.29
IV, South	1.12	1.12
V, West	1.13	1.16
VI, Far West	1.16	1.17

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current total of base entrance salaries for ASCE Grades I, II and III by an arbitrary base. The base used is $15,930, the total of salaries paid in 1956 for Federal Grades GS5, GS7 and GS9. Index figures are adjusted semiannually and published monthly in CIVIL ENGINEERING. Latest survey was December 31, 1960.

Advisory Committee to Societies Personnel Service

San Francisco Advisory Committee of Engineering Societies Personnel Service holds its annual meeting. Attending (left to right, seated) are Chairman Eric Salo, representing ASME; retiring Chairman Bennet L. Raffin, representing ASCE; E. V. Noe, representing AIEE; and Alfred H. Meyer, executive director of ESPS. Standing, in same order, are Lauress L. Wise, ASCE and Engineers' Club of San Francisco; Heino Jogis, ASCE; W. Carl McCulloch, AIME; Morris Weitzner, Society of Naval Architects and Marine Engineers; and Joseph R. Decker, manager of the San Francisco office of ESPS. The Engineering Societies Personnel Service, which operates in cooperation with the five major engineering societies, is available to all engineers on a non-profit basis.

Spokane Section Host to Pacific Northwest Council

Arrangements have been completed, under the chairmanship of Karl Strange, for the 13th annual conference of the Pacific Northwest Council, to be held at the Davenport Hotel in Spokane, April 20-22. A Local Section Conference, arranged by Bryan Barber, is scheduled for all day Thursday, with a kickoff party that evening.

Friday features include a luncheon, afternoon technical sessions, and a Western Roundup in the evening (barbecued buffalo and saltwater steak on the menu!). On Saturday morning separate technical sessions will be held on urban renewal, hydraulic and sanitary, structural, and special projects engineering. In the afternoon there will be a choice of several field trips related to the subjects discussed in the morning technical session.

An interesting program is planned for the ladies, too, under the chairmanship of Mrs. John Esvelt. Harold F. Sitts is retiring Council chairman. John Esvelt will be installed as new chairman of the Council during the Friday luncheon.

Allston T. Cushing (left) as he receives a Life Membership Certificate from Kansas City Section member S. J. Callahan. Currently a consulting engineer in Kansas City, Mr. Cushing was valuations engineer with the U.S. Department of Agriculture for 28 years.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

LOCAL SECTION MEETINGS

Connecticut—Joint meeting with the Student Chapter of the University of Connecticut on the campus at Storrs, on April 18.

Cleveland—Regular monthly meeting at the Cleveland Engineering and Scientific Center, Cleveland, on April 21.

Georgia—Evening meeting sponsored by the Student Chapter of the Georgia Institute of Technology, Atlanta, on May 5.

Hawaii—Honolulu Post Convention Tour following the 1961 Phoenix Convention, April 20-21.

Los Angeles—Special general meeting on the campus of the University of California at Los Angeles, on May 10.

Metropolitan—Joint meeting with the New York District of the American Society of Testing Materials and the Concrete Industry Board in the Engineering Societies Building, New York, on April 19, at 7:00 p.m.

Mid-South—Annual spring meeting in Vicksburg, Miss., April 27-29. Host for the occasion is the Vicksburg Branch.

Philadelphia—Annual installation meeting sponsored by the Women's Auxiliary of the Philadelphia Section at the Engineers Club, on May 13, at 7:30 p.m.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday, at 12 noon.

St. Louis—Regular monthly luncheon meetings at the York Hotel on the fourth Monday of each month, at 12:15 p.m.

Tennessee Valley—Annual spring meeting at the Hotel Sevier, Johnson City, Tenn., May 19-20.

Texas—Annual spring meeting at the Roosevelt Hotel, Waco, April 20-22.

At its meeting on March 9, the **Connecticut Section** conducted a panel discussion on developments in civil engineering education. Panel members were Robert S. Ayre, professor of civil engineering at Yale University; Herbert A. Sawyer, professor of civil engineering at the University of Connecticut; William P. Kimball, dean of the Thayer School of Engineering at Dartmouth College, and Henry A. Pfisterer, consulting engineer and professor of architectural engineering at Yale University. Dean Kimball discussed the activities of ASCE in educational matters. Professors Ayre and Sawyer, who were delegates to the Michigan Conference on Civil Engineering Education last summer, discussed the thinking of educators on the subject of civil engineering education in the future. Mr. Pfisterer, the last speaker, expressed his views as a practicing consultant, broadened by his own experience in the education of engineers and architects.

Highlights of the annual business meeting of the **Kentucky Section** were a film, "New Shapes in Concrete," a discussion of thin shelled reinforced concrete designs, presentation of Life Membership Certificates to Don B. Shipman and George W. Rapp, and the election of the 1961 officers. Elected to the first and second spot, respectively, were David K. Blythe and Robert M. Gillim, while Calvin C. Grayson was chosen secretary-treasurer, and James E. Humphrey, Jr., corresponding secretary.

Richard Z. Zimmermann, Jr., currently a director of the **Philadelphia Section** has joined the staff of the Committee on Publications to assist in the preparation of the monthly editions of "The News." Mr. Zimmermann, in addition, will serve as liaison between the Board of Direction and the Public Relations Committee.

The annual winter meeting of the **South Carolina Section** was held jointly with the South Carolina Society of Engineers and consisted of two technical sessions, business meeting, luncheon and banquet. At the business meeting, National President Glenn W. Holcomb, addressed the members on current ASCE activities; followed by presentation of Life Membership Certificates to C. P. Roberts and L. W. Pollard. Elected to serve for one year as president was Robert C. Blair; as vice president, Harold S. Wrenn; and as directors-at-large, W. Kenneth Johnson, Wortham W. Dibble and Frederick W. Wagener. The secretary-treasurer, Albert E. Johnson, will serve for two years. Other important business included approval of the formation of the **Eastern Branch,** approval of the revised Constitution and By-laws of the **Central Savannah River Valley Branch,** and the election of Julian E. Head as director of the Central Savannah River Valley Branch and Russell A. McCoy, Jr., as director of the Northwest Branch.

Edward L. Ullman, director, and Blair T. Bower, assistant director of the Meramec Basin Research Project at Washington University in St. Louis, Mo., when they spoke recently before the membership of the **St. Louis Section** were optimistic that development of the Basin would become a reality. People in the St. Louis area are intensely interested in the development of the Basin because of its proximity to the metropolitan area. At the Section's February luncheon meeting, J. J. Corbett, chief engineer of the Missouri State Highway Department, reported on current studies and highway problems before the state legislature. These problems are of prime concern to the public in general, and the engineer in particular, because they involve large expenditures of state and Federal money.

This month the Student Chapter of the University of Tennessee appeared in the news on three separate occasions. Top news was that the **Tennessee Valley Section** has again voted to continue its annual scholarship for senior civil engineering students at the University. Also in the news was Jeanette Denny, currently a senior at the University of Tennessee, who when she graduates next December will be the first girl to successfully complete undergraduate studies in civil engineering. Miss Denny, editor of the Student Chapter page in the "Tennessee Valley Engineer" plans to return to the University for a master's degree. Another facet of her personality was shown by her recent crowning as Engineers' Dream Girl at the Annual Engineers' Ball held on campus. The film, "Taming a New Frontier" (narrated by Chet Huntley), was the feature attraction at the Chaper's monthly meeting. It is about the remote region of northern Arizona and Southern Utah where Glen Canyon Dam is under construction and where the highest arch bridge in the world spans the Colorado river.

(Continued on page 78)

Administrative Headquarters, International Salt Company, Clarks Summit, Pa. Architects-Engineers: Von Storch & Burkavage. General Contractor: Breig Bros. Steel Fabricator and Erector: Anthracite Bridge Company, who fabricated and erected some 450 tons of Bethlehem structural shapes for this building.

A handsome steel frame for "Salt Headquarters"

Steel *for Strength . . . Economy . . . Versatility*

Entrance from parking lot. Note unusual effect achieved by hanging roofs on the lower flange of the roof beams, instead of the upper flange.

Balcony of the lounge-cafeteria wing overlooks a beautiful valley. All columns and beams supporting this balcony are left exposed and painted red.

Colorful curtain walls make an eye-appealing exterior. Porcelain-enameled steel panels are blue, steel columns and beams are red.

Steel-framed "floating" staircase dominates the handsome main entrance lobby.

Wherever you look at the new administrative headquarters of International Salt Company, you see steel—exposed structural steel framing, steel roof deck, porcelain-enameled steel panels outside, steel wall partitions inside.

This attractive building dominates a hilltop in a country setting outside Scranton, Pa. Great expanses of glass, glazed to slender steel columns, bring the surrounding countryside inside to join the brightly painted interior. Blue porcelain-enameled steel panels complete the curtain-wall construction, and provide a striking contrast to the exposed steel frame which is painted red.

International Salt wanted a *flexible* building. And they got it, thanks to steel construction. It will be a simple matter to add a new steel frame to the existing one if expansion becomes necessary. The interior steel wall partitions are easy to take down and re-erect, and make possible many variations in room arrangement.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, Bethlehem, Pa. *Export Sales:* Bethlehem Steel Export Corporation

Structural frame is exposed inside, too. Here it lends beauty to the employee lounge and cafeteria (rear), and emphasizes the sturdiness of the structure.

Steel wall partitions throughout the building provide complete interior flexibility.

President of the Central Ohio Section for 1961, Harry H. Hawley, is flanked on his left by S. W. Dudley and Stanley P. Belonos, first and second vice president, respectively, while Robert F. Baker, past president, and Robert H. Akers, secretary-treasurer, are on his right. A record turnout of 75 attended the February 16 luncheon meeting to see Section members William P. Cross, Harold P. Brooks, O. H. Jeffers and Lawrence C. Crawford receive Service Awards for 30 years of service with the U. S. Geological Survey.

Delaware's Governor Elbert N. Carvel signs a Declaration proclaiming the week of February 19-25 as Engineers' Week in Delaware. Flanking the Governor, in usual order, are Ralph W. Smith, president of the Delaware Council of Engineering Societies; Delaware Section members William J. Miller, Jr., and George W. Dutcher, who is assistant chairman of Engineers' Week; Robert E. Seddon, assistant general chairman of Engineers' Week, and Chauncey O. Simpson, also of the Delaware Section.

Some 50 members and guests of the Hawaii Section were on hand recently to welcome the Section's 1961 officers. Looking on as retiring President Wayne E. Duncan (second from right) congratulates his successor, Russell L. Smith, Jr., are (left to right) Raymond D. Wygant, secretary; Hajime Tanaka, treasurer; C. Dudley Pratt, associate director; Robert T. Chuck, second vice president; and Paul E. S. F. Liu, first vice president.

ASCE CONVENTIONS

ANNUAL CONVENTION
New York, N. Y.
Hotel Statler
October 16-20, 1961

HOUSTON CONVENTION
Houston, Tex.
Hotel Shamrock
February 19-23, 1962

OMAHA CONVENTION
Omaha, Nebr.
Sheraton-Frontenelle
May 14-18, 1962

TECHNICAL DIVISION MEETINGS

AIR TRANSPORT CONFERENCE
Miami Beach, Fla.
Carillon Hotel
May 11 and 12, 1961
Sponsored by
Air Transport Division
Airport Operators Council

ENGINEERING MECHANICS DIVISION CONFERENCE
Troy, N. Y.
Troy Building
Rensselaer Polytechnic Institute
May 18 and 19, 1961
Sponsored by
Engineering Mechanics Division

SYMPOSIUM ON WATER RESOURCES AND RECLAMATION
Fort Collins, Colo.
Colorado State University
June 12-15, 1961
Sponsored by
U.S. Bureau of Reclamation
Colorado State University
ASCE

HYDRAULICS DIVISION CONFERENCE
Urbana, Ill.
University of Illinois
August 16-18, 1961
Sponsored by
Hydraulics Division

DISTRICT CONFERENCES

PACIFIC NORTHWEST COUNCIL
Spokane, Wash.
Davenport Hotel
April 21-22, 1961

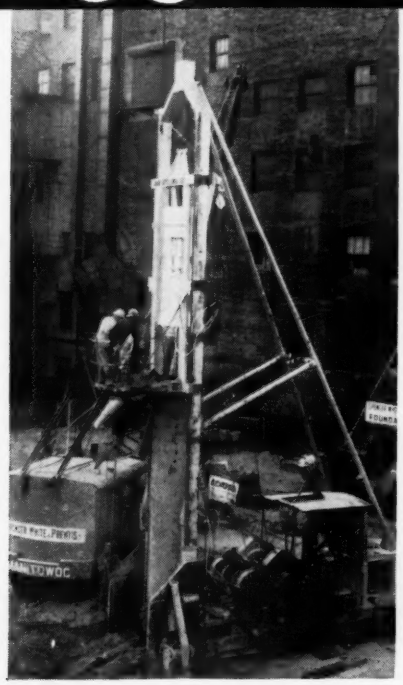
DISTRICT 16 COUNCIL
Des Moines, Iowa
Fort Des Moines
May 6, 1961

DISTRICT 9 COUNCIL
Cincinnati, Ohio
Hotel Netherlands Hilton
May 12 and 13, 1961

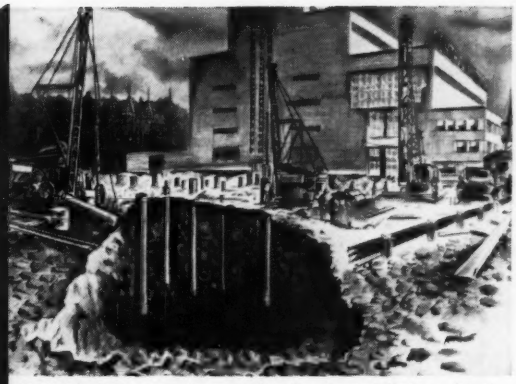
DIFFICULT FOUNDATION WORK:

Count on Spencer, White & Prentis—specialists for over 4 decades

We are equipped to provide complete dependable service on the various types of foundations pictured here or any other specialized foundation problem.



Machine-drilled caissons. Benoto machine shown at left.



Drilled-In Caissons: steam station for Central Hudson Gas & Electric Corp., Danskammer Point, Roseton, N. Y.

Pipe piles: industrial service building for Colgate-Palmolive Company, Jersey City, N. J.

H-Beam piles: 145,000 linear ft. driven for addition to Smithsonian Institution, Washington, D. C.

Open piers to rock: Battery Parking Garage, New York, N. Y.

Spencer, White & Prentis INC.

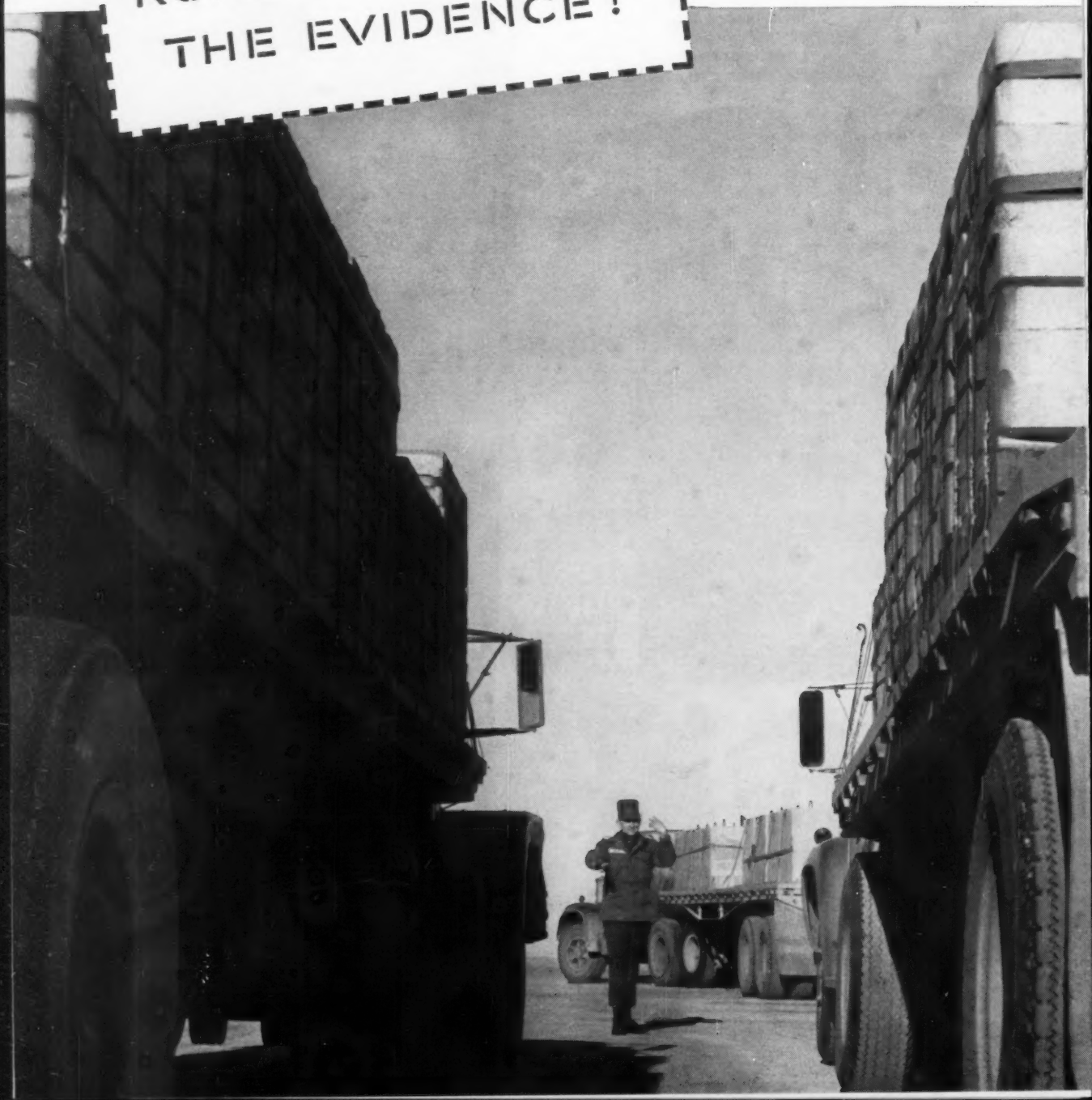
10 E. 40th St., New York 16, N. Y.

Detroit: 2033 Park Ave. • Chicago: 221 North LaSalle St. • Washington, D. C.: Tower Bldg.

FOUNDATIONS • PILING • UNDERPINNING
SHORING • COFFERDAMS • SPECIAL SERVICES

Concrete wins these

NATIONAL
ROAD TEST GIVES
THE EVIDENCE!



over asphalt basic ways...

1 DURABILITY

A count of pavement sections surviving in the great National Road Test, after two full years of traffic, showed concrete outlasted asphalt 3 to 1! Here is new confirmation that concrete gives more for tax dollars.

2 DRIVING COMFORT

In ratings of how test pavements retained the riding quality they started with, concrete won over asphalt by a wide margin. Conclusive evidence that only concrete can give lasting driving comfort and do it without excessive maintenance.

Sponsored by the American Association of State Highway Officials (AASHO) . . . directed by the Highway Research Board of the National Academy of Sciences —National Research Council. Here is the most scientific pavement test ever made. Accurate instrumentation checked performance of test sections during 2 full years of traffic. 99 trucks, 19 hours daily, 6 days a week. There were 17 million miles of travel—1,113,762 load applications!

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

DON'T BE FOOLED BY INITIAL PIPE COSTS...

Certain factors concerning the type of pipe to be used for a proposed water or gas project must be examined carefully:

First
—how much does the pipe cost, compared to other types?

Second
—how often will it require repair?

Third
—how long before it has to be replaced?

After all, how much money do you really save if you buy the cheapest pipe . . . then have to repair it frequently . . . and *then* have to replace it within a decade or two?

You save with cast iron pipe

Sometimes the first cost of jobs where cast iron pipe is specified, is higher than similar projects using cheaper pipe. Yet, in the long run, cast iron pipe costs *less!* Here's why:

- Cast iron pipe rarely requires repairs. Its rugged construction, corrosion-resistant qualities and bottle-tight rubber-ring joints will withstand the most severe pressures. Once an investment is made in cast iron pipe, it is usually your first and last cost because of the absence of maintenance or repairs.

- Cast iron pipe is built to *last*—98 American cities will testify to that. They've had cast iron pipe installations in constant use for over a century! In fact, in Versailles, France, they're still using cast iron pipe water mains that were laid in 1664! Once cast iron pipe is in the ground, it stays there!

Don't be fooled by "low-cost" pipe. Insist on the pipe that will actually save you money over a period of years . . .

In Nebraska—Here a section of cast iron pipe is being relocated. Twenty-five years old, the pipe is still in excellent condition—has never required major repair . . . or replacement.

Rely on CAST IRON PIPE

In Indiana (above)—"All-weather" cast iron pipe is quickly installed despite wet trench conditions. Slip-on joints were easily assembled, with one workman using a crowbar.

In Kansas (above)—36" cast iron water main. Another part of this main was floated out of its trench by a heavy downpour. Later a 150 psi water test revealed no leaks in the slip-on joints!

In Pennsylvania (below)—This 16" cast iron pipe is being installed as fast as the trench hoe can prepare the trench.

Handy lengths and slip-on joints make cast iron pipe easy to handle, even in crowded neighborhood sectors; require less labor.

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Cast Iron Pipe Research Association,
Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois

BY-LINE WASHINGTON . . . . .

One could read strong support for the Corps of Engineers—as well as sharp criticism of the Air Force and private architect-engineer firms—into a report by a House subcommittee on the progress of **missile base construction work.** The committee's comments were strongly backed by testimony of contractors who have worked on the big ICBM bases: they pointed up the charge that the Air Force has "intruded" to such an extent that normal relations between contractors and the Corps of Engineers have been disrupted.

The subcommittee report (Subcommittee on Military Construction of the House Appropriations Committee) centered on a number of points: (1) bad management by the Air Force should be eliminated by appointment of a single top-echelon construction "czar"; (2) "ivory tower" estimating by architect-engineers must be eliminated; (3) there should be no revival of attempts to build a major engineering corps within the Air Force; (4) the abnormal number of change orders must be cut.

The real complaint of the contractors—and the one the committee selected for its principal recommendation—was the charge of "intrusion." Said one contractor: "Our contract is with the Corps of Engineers . . . not with the Air Force, the architect-engineer, or the weapons system manufacturer. Nevertheless, it is obvious that the latter three are controlling in almost all decisions . . . we cannot and should not have to deal with them or be controlled by their unilateral decisions. . . . The relationship between the contractor and the contracting officer . . . no longer exists. . . . The construction agency is now being directed . . . by the using agency to a degree never known before, and certainly never contemplated . . . when we entered into these contracts . . ."

* * *

On **industry infighting,** two major materials associations jumped the gun on the results of the American Association of State Highway Officials' **road test,** just completed at Ottawa, Ill. Thumbnail history: Last November, J. E. Buchanan, president of The Asphalt Institute, signed an article in the *New York Journal of Commerce* discussing the road test results, gave no specific figures but stressed the point that the road test was "not conceived as an elimination contest between paving types," winding up with a statement that the asphalt industry is now "under the burden of explaining to the uninitiated the conditions of the test."

The Portland Cement Association took offense at this latter statement, in particular, and answered with double-page advertisements in five national magazines (and press releases) early in March, with black headlines claiming that concrete outlasted asphalt by 3 to 1 in the road test, quoted percentage figures to back its claim.

AASHO officials made no public comment. However, it was obvious they were worried about the effect—with memories of a road test in Maryland some years ago, results of which were largely discredited in the public mind by rival claims of various special interest groups.

Much of **President Kennedy's program** is now before Congress—and most of it affects construction, though the influence on engineering itself is secondary. Involved are really enormous sums over a period of years: Up to $5.7 billion for various items of aid to school construction; up to $600 million for contruction of hospital and health-teaching institutions; up to $3 billion for housing and redevelopment; $390 million for area redevelopment including rural areas; as yet undisclosed totals for natural resources development; $125 million yearly for pollution abatement; and more. Much of this program is rated as standing a good chance of passage.

* * *

Two major **interstate water compacts,** both in the northeast, are before Congress for approval now. Both are of prime interest to engineers. They differ widely in their terms: One, a compact for regulation of waters of the Delaware River basin in Delaware, New Jersey, New York and Pennsylvania, would give its five-man commission broad powers to formulate programs and carry them out—a possible $500 million, 50-year construction program is envisioned. The others, involving Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont, would give its "Northeastern Resources Commission" powers only to survey conservation needs of the area, make recommendations as to action that might be taken. There is little doubt both compacts will be approved—the federal government would have members on the boards of both compacts.

* * *

The **Federal Aviation Agency** will adhere—with some exceptions—to the previous policy of lending no money for construction of airport "frills." That was clear enough in the first press interview granted by FAA Administrator Najeeb E. Halaby. The new air boss said that he couldn't see supplying federal money for other than safety purposes at airports where the local community could presumably support a terminal building and facilities through revenues. Exception would be made, for an airport where such facilities couldn't be supported because of lack of population, industry, or other factors.

* * *

The Corps of Engineers has announced **new clearance requirements** for bridges across the Mississippi River. The new criteria call for navigation clearances of not less than 45 ft above river levels reached 98 percent of the time, 50 ft at normal navigation pool stages. These clearance heights represent a reduction of 10 and 13 ft, respectively, under previous requirements, but they are a compromise between the demands of boat operators (who want 55-ft clearances above normal river levels) and highway interests (who want 35-ft clearances).

* * *

There is considerable speculation as to who will be the new Chief of Army Engineers. Lt. Gen. Emerson C. Itschner, F. ASCE, who was appointed to the post in October 1956 and, in an unusual action, reappointed for two years by President Eisenhower in 1960, asked that he be relieved on March 31.

Control concrete setting with J-M Retardwel...

the hot weather admixture that gives up to 50% higher 24-hour strength

Retardwel®, a product of Johns-Manville, world's largest industrial user of portland cement, is the liquid admixture that controls concrete setting time and prevents premature stiffening due to high temperatures *without* loss of early strength.

Retardwel permits a reduction in the water required for proper placing and provides all the advantages of concrete fabricated with a minimum paste content. Its use delays the initial set of concrete and provides a slower rate of heat evolution, thereby minimizing thermal stresses. Thus, the use of Retardwel will aid in eliminating shrinkage cracks. Only 3 ozs. of Retardwel per sack of cement will control setting time (see chart) and still increase 24-hour strength as much as 50%.

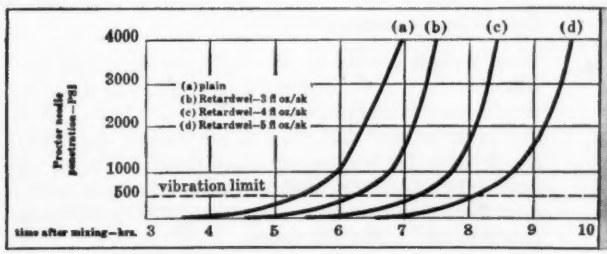
Retardwel's unique properties will also—

- Increase durability
- Improve dimensional stability
- Increase workability
- Reduce permeability
- Increase density

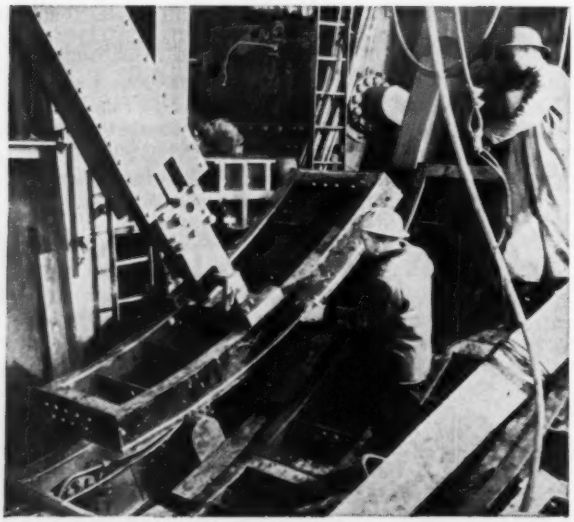
For normal weather conditions, J-M Placewel® is recommended. Johns-Manville's two concrete admixtures have gained the acceptance of architects and engineers throughout the world. For full information write: Johns-Manville, Box 14, New York 16, N. Y.

JOHNS-MANVILLE
Celite Division

JOHNS-MANVILLE JM PRODUCTS



COMMERCIAL STEEL LINERS—Support and seal Callahan Tunnel. Sponsor: Massachusetts Turnpike Authority. Consulting and Designing Engineers to the Authority: Singstad & Baillie, New York City. Contractor: Perini Corporation, Boston.



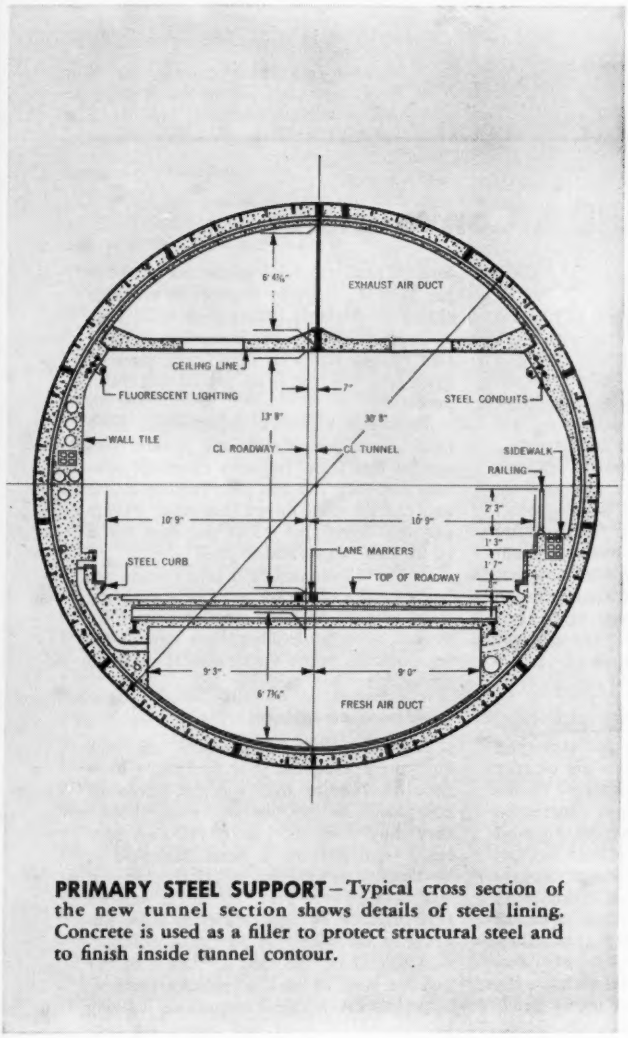
ERECTING "A" PLATE—Erector arm positions 1500 lb. ring segment. Note side flange gasket between bolt holes and skin plate.

How Steel Liners

New design concept of primary tunnel lining calls for fabricated steel plates in new 4848 ft., two lane, $29,000,000 vehicular tunnel

With completion expected ahead of schedule late this year, the Lt. William F. Callahan, Jr. Tunnel will be the Massachusetts Turnpike Authority's answer to existing traffic congestion in the present Sumner Tunnel under Boston Harbor. The Callahan project parallels Sumner Tunnel and will provide capacity for at least double the traffic load that currently can be handled.

Basic Requirements—A watertight, corrosive free primary tunnel lining, 100% load carrying, sections of which would have a clay blanket coverage of only 20 feet . . . A lining that must be easy and quick to erect inside the tailskin of the shield as the heading advanced through ground varying from silt to hard clay and hardpan . . . A long, hard look at construction cost to assure a toll facility economically practical and financially sound.



PRIMARY STEEL SUPPORT—Typical cross section of the new tunnel section shows details of steel lining. Concrete is used as a filler to protect structural steel and to finish inside tunnel contour.

INJECTING SEALANT—Waterproofing corner joints at gasket butt ends through grease type fitting in corner of each liner plate.

TAPPED GROUT HOLE—Placed in each liner plate, it provides connection to grout voids outside steel lining.

Support Watertight Boston Harbor Tunnel

How COMMERCIAL Helped—For the primary lining, we assisted the design engineers in developing this new type of lining. COMMERCIAL fabricated liner plates sufficient for 1813 complete rings. Each ring is 32″ wide, curved to 30′ 8″ outside diameter. Eleven plates were required per ring and the standard "A" plate weighs about 1500 lbs. Each plate was fabricated from steel parts welded into a complete component. Fabrication included all flange holes used for bolting plates together. Extremely close tolerances had to be maintained—flange flatness was to $+\frac{1}{32}$″ -0″. Overall dimensions and plate curvature had to be held to very exacting requirements.

A longitudinal machined groove was placed in one side flange and in one end flange of each plate to hold a $\frac{3}{8}$″ square gasket. Strategically placed outside all flange bolts, this gasket seals out all water before it can reach any bolt holes. Thus, caulking around all bolt holes and segment joints is eliminated.

Through a special fitting placed near a corner of each plate provision was made to pressure-inject polysulfide synthetic rubber sealant to fill any potential voids that might exist where ends of gaskets meet. Thus, the steel lining was made completely watertight.

The outer surface of each plate was covered with a heavy, tough, protective coating of hot-applied asphaltic enamel.

The Result—For the first time, a completely dry tunnel having a 100% load bearing, corrosive free fabricated steel primary lining with a poured concrete secondary lining which serves only to finish interior contours.

The full story of how the Callahan Tunnel was built for the Massachusetts Turnpike Authority is available and can be obtained free of charge by writing to Commercial Shearing & Stamping Company, Dept. C-13, Youngstown 1, Ohio.

COMMERCIAL shearing & stamping

News Briefs...

Meeting Notes from ARBA Convention

Prompt acceptance of new equipment and changes in specifications to permit its immediate use is a pressing need in highway development. This was a constantly recurring theme in talks at the American Roadbuilders Convention, held in Atlantic City, March 5-8.

During the meeting, the Roadbuilders elected Ralph R. Bartelsmeyer, chief highway engineer of the Illinois Division of Highways, as president to succeed Nello L. Teer, Jr., as head of the 7,000-member national organization.

The group passed several resolutions to expedite roadwork. These endorsed the financing policy of President Kennedy, providing for the completion of the Interstate Program with no stretch-out and no cut-back; supported the President's program for increasing ABC (other roads) authorizations; urged all to expedite construction of highways and to consider plans for emergency programs as a spur to employment; and petitioned Congress to obligate $100 million annually for the Federal Aid airport program.

At a symposium on highway equipment Donald V. Buttenheim, president of the Construction Industry Manufacturers Association, asked that specifications be quickly adopted to permit new developments to replace outmoded units with new and more efficient types. As moderator, H. A. Radzikowski, chief of the Division of Development in the Bureau of Public Roads, commented on the 350,000 major units of construction machinery and motor vehicles owned by 11,000 highway contractors and supporting rental equipment agencies. This equipment has a replacement value of $4 billion and, if fully engaged, is capable of producing $8 billion worth of on-site highway construction annually. Public agencies operate 400,000 units of construction machinery with a replacement value of $2 billion in maintaining 3.4 million miles of highways and streets.

A large panel of equipment experts prepared papers and answered questions on all phases of equipment development. The papers were briefed for meeting presentation and will be available from the ARBA later. It was pointed out that earthmoving costs have not risen because the manufacturer-contractor team has been permitted to develop more efficient equipment and methods without restrictive specifications on how to dig, push or haul.

Earthmoving equipment is more compact and has more power for size than in the past. A new dry-type air cleaner has an efficiency of 99.8 percent. Transmission developments have increased production from 25 to 40 percent. New oil brakes and oil clutches reduce adjustment time to one-fifth of that previously required. Big tractors have doubled in power since 1946; rippers now open up many areas formerly blasted at a reduction in earthmoving cost to only one-third of that to shoot, load and haul. An electronic device placed on motor graders has increased the productivity 50 percent and reduced the engineering required in staking a job by 70 percent.

A major development in the 600 million tons of road material processed per year has been the increase in capacity and efficiency of portable plants with units now as large as 700 tons per hour. Standardization among states so that fewer sizes of aggregate are required is the big need here.

Seventeen highway departments have used or will permit slip-form pavers. Successful operation requires excellent subbase but they can use wire reinforcement and can do most things that other pavers can do. Speeds of 12 ft per min for a 10-in. slab can be maintained.

In the bituminous field larger units are being produced for all parts of the paving train. Highly portable smaller units have proved successful. There are new leveling controls, some visual and some electronic, that are valuable aids.

Equipment acceptance

Incentive for development of new equipment frequently is lacking. Specifications require that specific pieces of equipment be on the job, even though they may never be used. While an end-result specification is most desirable in developing more economical machines it was pointed out that this might require real research by contractors to meet unusual requirements. A means of compaction should be specified so that a bidder can be sure of one acceptable method.

An ARBA-AASHO committee is being considered to assist and advise on construction standards with a view to keeping them flexible so that integration of improved equipment will be helped, not

Seattle Prepares for Century 21 Exposition

Public utility developments of the Pacific Northwest will be featured in exhibits in commerce and industry being prepared for Seattle's Century 21 Exposition. This is a model of the hydroelectric structure being built by electric utilities of the region. Displays in this structure will depict the benefits of water power, the state's greatest natural resource. Century 21 Exposition, the first international exposition to be held in the U. S. since 1939-1940, has the theme of "Man in Space." Prime exhibitors will include the U. S. Government with a $9,000,000 program featuring a five-unit Science Pavilion. A monorail, linking downtown Seattle with the centennial site, will be a prototype of high-speed, mass-transportation of the future.

hindered. Design standards have been established for all of the country. It is believed that construction standards can and should be so established at once.

Panel on education

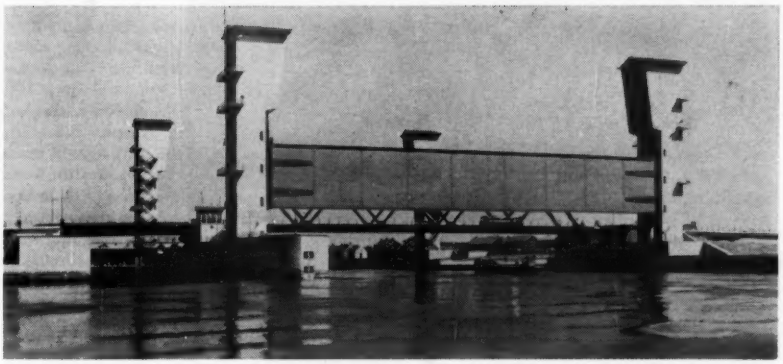
A panel on education was moderated by E. H. Karrer, of Ohio State University, with P. F. Hobart, of Birmingham, speaking for contractors, ASCE Past President Mason G. Lockwood, of Houston, presenting the consulting engineer's viewpoint, and George M. Foster, F. ASCE, of Indianapolis, representing state highway departments. Mr. Hobart commented that engineers need training in practical judgment, cost accounting, a course in plan reading, some instruction in how to make up an estimate and in preparation of engineering reports. Courses are needed in both geology and soil mechanics as problems in compaction have slowed highway work more than any other single feature. Also needed are public speaking, supervising personnel, and a study of modern equipment and methods.

Mr. Lockwood pointed out that most engineers get into different fields from those for which they were specifically trained. However, he has found many civil engineering graduates weak in the basic principles of structural design. The private firm needs men who can design highways and bridges, and who can also design building frames, industrial and waterfront structures, dams, water distribution and treatment systems. "I would be willing," said Mr. Lockwood, "to see the schools sacrifice almost anything to provide more adequate skill in communication, written and oral, and an inextinguishable zeal for more learning of all kinds."

Mr. Foster told about indoctrination courses for high school graduates that serve to enlist technicians for their highway work and, at the same time, serve as an introduction to engineering. He recommended closer liaison with college teachers, perhaps through field work in summer and better training in economics, administration and public relations.

Rex Whitton, F. ASCE, in one of his first speeches as Federal Highway Administrator, said the only change he foresees in the highway program is a speedup. The original schedule should be maintained on a pay-as-you-go basis. The Interstate and ABC systems will require authorization of an additional $11.5 billion and $10 billion of revenue channeled into the Highway Trust Fund for completion by 1972.

ASCE members elected to top positions in ARBA include Maurice N. Quade, partner, Parsons, Brinckerhoff, Quade and Douglas, New York, president, Engineering Division; Mason G. Lockwood, of Lockwood, Andrews and Newnam, Houston, vice president, Engineering Division; Joe Abramson, engineer of Caddo Parish, Shreveport, La., president, County Division; and Ellis Danner, professor of highway engineering, University of Illinois, president, Educational Division.



Storm-Tide Barrier Aids Dutch Fight Against Floods

Powerful instrument in Holland's continuous fight against flooding from the sea is this new movable storm-tide barrier in the mouth of the Hollandsche Yssel River near Rotterdam. Completed recently, the barrier can shut off the river from the sea whenever the water threatens to rise to a dangerous level. The barrier consists of two movable steel gates—arranged one behind the other—which are suspended and lowered from concrete lift-towers. Each gate is 266 ft long, 37½ ft high, and weighs 635 tons. The storm-tide barrier is part of Holland's Delta Plan for protection of its coastal dikes and for combating salinization of the soil. The Delta Plan also involves construction of a dam, a number of sluices, and a lock for shipping, all scheduled for completion in 1968.

Construction Spending Declines in February

The total value of new construction put in place in February amounted to $3.6 billion, according to preliminary estimates of the Bureau of the Census of the U. S. Department of Commerce. This amount was 6 percent less than the January total, compared to a normal seasonal decline of 5 percent between January and February. Spending for new construction in February 1961 was 1 percent less than in February a year ago. The effects of unusual weather conditions, during the past few months, are reflected only in small part in these estimates of construction activity.

New private construction expenditures this February amounted to $2.6 billion. This amount was down 5 percent from January, and 6 percent below the February 1960 total. Spending for construction of private nonfarm residential buildings in February amounted to $1.3 billion, 8 percent less than in January and 12 percent under the February 1960 level. Spending for new public construction expenditures this February, at $1.0 billion, was 7 percent less than in January but 13 percent above February 1960 outlays.

Construction spending in the first two months of 1961 amounted to $7.38 billion, slightly less than the $7.43 billion spent in the comparable period of 1960. Comparative estimates for the same two-month periods show that while private construction expenditures declined 5 percent in the corresponding period of 1961, public expenditures were up 14 percent.

U.S. Firm Receives Indonesian Contract

Morrison-Knudsen International Constructors have received a $38,000,000 contract from the Indonesian Government for construction of a new urea plant at Palembang, Sumatra. The plant will have an annual capacity of 100,000 metric tons of urea—a soluble crystalline compound of nitrogen used chiefly as a commercial fertilizer. The urea will be processed from natural gas piped to the site from nearby gas fields.

Associated with Morrison-Knudsen on the project will be its subsidiary, the H. K. Ferguson Company, of Cleveland, Ohio, and the Girdler Construction Company, of Louisville, Ky.

Engineering Firm Wins Negligence Suit

In a suit brought against the Harrisburg, Pa., consulting firm of Gannett Fleming Corddry & Carpenter, Inc., by the City of Daytona Beach, Fla., in the U.S. District Court for the Southern District of Florida, the jury has returned a unanimous verdict for the engineering firm. The verdict, returned on January 19, completely vindicates the firm's position that its engineering services rendered the city for the design and supervision of construction of a municipal paving program in 1949-1950 were strictly in accordance with accepted engineering standards and practice.

Bridge to Carry Aggregate for Ice Harbor Dam

A 930-ft suspension bridge has been erected over the lower Snake River at Pasco, Wash., for the sole purpose of hauling aggregate from one side to the other by conveyor belt. In all 1¼ million tons of sand, gravel, and rock will be moved from the south to the north side of the river. The constantly moving belt, supplied by B. F. Goodrich Industrial Products Company, carries 660 tons of aggregate an hour at a speed of 300 fpm to the construction site of the Ice Harbor Lock and Dam. It is 2,400 ft long and 30 in. wide. The $135,000,000 lock and dam project is the first of four planned between Pasco, Wash., and Lewiston, Idaho, for power and to increase the navigability of the Snake. The Guy F. Atkinson Company, of San Francisco, is contractor for the Corps of Engineers.

Russian Concrete Practice Studied at ACI Meeting

Widespread use of reinforced concrete is responsible for the tremendous program of urban construction under way in Russia today, and in the wake of this program remarkable strides are being made in concrete science and technology. Speaking at the 57th annual convention of the American Concrete Institute, held in St. Louis, Mo., February 20-23, A. Allan Bates, F. ASCE, vice president for research and development for the Portland Cement Association, said that Soviet planners and technologists are placing increased emphasis on the production of precast concrete structures as the means of achieving maximum urbanization and industrialization in the shortest possible time.

Dr. Bates, who headed a U.S. delegation of concrete and construction specialists which toured Russia last summer, reported that today more than 2,000 factories are turning out precast concrete components, and that more factories are going into operation every month. These plants are automated to such an extent, he explained, that the high capital investment would be seriously questioned if resorted to in comparable factories in the U.S. Their productivity in terms of completed apartments, industrial buildings, transportation structures is most impressive. For instance, every unit of the apartment building is precast, including foundations, walls, floors, roofs, stairways and, when used, beams, columns, and girders. Complete precast kitchens and baths with all service lines cast in place are delivered to building sites. With such procedures in use, the erection crew may consist of little more than a crane operator and six semi-skilled workers to attach crane slings and connect fittings.

Dr. Bates said that Soviet technologists have also developed built-in protection against the harsh Russian winters. Sandwich panels with foamed concrete cores are a standard product. Extensive use is also made of lightweight insulating aggregates, of porous concrete with open gap-graded aggregate mix, of double waffle-slab panels enclosing central insulating air zones, of concrete mixes incorporating wood fibers and other nonconducting organic substances. All these products are factory produced, after development in one of several government-owned central research institutes.

In a Design and Construction session, John J. Reed, professor of mining engineering at the Colorado School of Mines, and C. David Mann, of the St. Joseph Lead Company, Terre Haute, Mo., described a joint effort of the company's Mine Research and Mine Operating Departments to develop stronger, more effective concrete pillars for underground mine support. Another important paper in this session was concerned with the supporting structure for the retractable roof of the Pittsburgh Public Auditorium. Resting on 48 concrete A-frames, the reinforced concrete ring girder supports three sets of tracks on which ride the six movable leaves partially making up the dome of the arena. The reinforced concrete podium deck consists of a 10-in.-thick concrete slab, about 50 ft wide, that is supported by columns running along the exterior, the center, and the inside perimeter. The authors were Edward Cohen, F. ASCE, associate engineer, Ammann & Whitney, New York, and H. Rey Helvenston, resident engineer for the Public Auditorium Authority of Pittsburgh and Allegheny County.

In an interesting Materials session paper, Edward A. Abdun-Nur, F. ASCE, consulting engineer of Denver, Colo., dealt with the provocative subject, "How Good Is Good Enough?" To determine how good concrete should be "to serve the purpose for which it is intended," the author examined several typical specifications and evaluated them statistically by relating the results obtained to physical job conditions. He found that (1) minimum strength specifications are unrealistic and are not being met in practice; (2) such specifications tend to obscure the real factor of safety; (3) specifications that permit the probability of a reasonable number of low-strength values are more realistic and fit more closely the results being obtained in practice; and (4) a probability of 10 to 20 percent of strengths below design strength provides better end-product concrete than that being obtained in current practice under a minimum strength specification.

ACI awards presented

Five engineers were honored with ACI awards during a luncheon meeting. The Turner Medal was awarded to Stanton Walker, F. ASCE, National Sand and Gravel Association, Washington, D.C., for his publications in the field of concrete and work on the Institute's technical committees. The Lindau Medal went to Anton Tedesko, F. ASCE, Roberts & Schaefer Company, New York, for his "outstanding contributions to the development and use of long-span concrete structures as exemplified by the thin-shelled arch." A. Allan Bates, F. ASCE, Portland Cement Association, Skokie, Ill., received the Kennedy Award "for untiring efforts as chairman of the ACI Building Committee," whose work culminated in the new Institute headquarters in Detroit. The Wason Medal for Research was awarded to Henry A. Toennies, M. ASCE, National Concrete Masonry Association, Washington, D.C., for the most notable research reported in an ACI Journal paper during the year. Robert A. Williamson, M. ASCE, Holmes and Narver, Los Angeles, received the Wason Medal "for the most meritorious paper."

New ACI officers

At the close of the convention Lewis H. Tuthill, of Sacramento, Calif., was installed as new president of the Institute, and Roger H. Corbetta, of New York City, began a two-year term as vice-president.

Contracts Awarded for Tagus River Bridge

The Portuguese Government has awarded a contract for construction of the huge Tagus River Bridge at Lisbon to the United States Steel Export Company in association with the International Morrison-Knudsen Company, Inc. The structure will be the longest clear-span bridge in Europe and the fifth longest in the world, exceeded only by the Golden Gate Bridge, the Mackinac Straits Bridge, the George Washington Bridge, and the Narrows Bridge now under construction.

A four-year project, the Tagus River Bridge will be almost two miles long, with a central suspension span of 3,318 ft and two side spans of 1,540 ft each. It will carry four lanes of highway traffic and will include provision for future installation of a double-track railroad. With approaches, the project will encompass more than eight miles of roadway. The deepest pier will extend 270 ft beneath water surface to bedrock, requiring excavation and foundation work at record depth. The main steel towers supporting the central suspension span will rise 625 ft above the water.

The United States Steel Export Company will be the prime contractor in overall charge of the project and will handle fabrication and erection of the bridge superstructure. The International Morrison Knudsen Company will build the bridge approaches, abutments, and the immense concrete piers, one of them the deepest in the world. Working with Morrison-Knudsen will be the French firm, Compagnie pour L'Etude et le Development des Exhanges Commerciaux. The firms of Steinman, Boynton, Gronquist & London, of New York City, and the Tudor Engineering Company, of San Francisco, are in charge of foundation investigations and engineering design.

N.Y.C. Authorizes Study of Hudson River Waterfront

A $300,000 economic, engineering, and architectural planning study of a six-mile section of the Hudson River waterfront between the Battery and 72nd Street was initiated early in March with the signing of a services contract previously approved by the Board of Estimate. The contract was signed by Commissioner Vincent A. G. O'Connor, on behalf of the City's Department of Marine and Aviation, and officials of three consulting firms. The study will be particularly concerned with the relation of the waterfront to the Port of New York in the years 1960 through 2000.

The consulting firms conducting the study are Ebasco Services Incorporated, management consultants; Moran, Proctor, Mueser and Rutledge, consulting engineers; and Eggers and Higgins, architects. All have their headquarters in New York. The three firms, acting as joint venturers, will retain Herbert B. Dorau, professor of economics at New York University and chairman of the university's public utilities and transportation department, as consultant. Dr. Dorau is a specialist in land use.

One of the immediate objectives of the study will be an inquiry into passenger ship terminal requirements, with a view to developing or redeveloping existing terminal facilities. The survey is the third to be undertaken by the Department of Marine and Aviation to determine the potential of the city waterfront. The other studies have been concerned with the East River commercial waterfront from the Battery to Corlears Hook and a mile of city-owned piers on Staten Island.

Rapid Transit Plan for San Francisco Approved

Directors of the Bay Area Rapid Transit District have given final approval to a $1,025,000,000 engineering plan for a high-speed rapid-transit system to serve the five central counties of the San Francisco Bay region. Following development of a method of financing the system, the entire plan will be in the hands of supervisors of the five counties by August 1 and will be presented to Bay area voters in June 1962.

The approved plan will provide a 119-mile network of tracks extending north from San Francisco to Santa Venetia in Marin County and south to Palo Alto in Santa Clara County on the west side of San Francisco Bay. On the east side, transit lines will radiate north from Oakland to Richmond, east to Concord in central Contra Costa County, and south to Fremont.

Tying the entire system together will be a four-mile transit tube under the Bay, which will connect the subway complexes in downtown San Francisco and Oakland. This segment of the system will be financed from surplus automobile tolls on the Bay Bridge. There will be 52 stations in the system. Parking facilities at 38 of these stations will provide space for 43,000 automobiles.

If the system is approved by the voters, major segments of it could be in operation as early as 1967.

Contract Awarded for Minuteman Missile Base

The Ballistic Missile Construction Office in Los Angeles has awarded a $61.8 million contract for construction of the huge Minuteman Missile Base at the Malmstrom Air Force Base, Great Falls, Mont. The winning joint venture group consists of the George A. Fuller Co., of New York, and the Del E. Webb Construction Company, of Los Angeles. The contract is subject to modification after the work gets under way.

Cable Sample Tested for Use in Narrows Bridge

Although cable spinning for the mighty Narrows Bridge is nearly two years in the future, engineers for the American Bridge Division of U.S. Steel in Trenton, N.J., are busy working out final specifications on a specially assembled cable sample. Two employees are shown using an extensometer to measure the elongation of the cable band bolts under strain. The cable band holds 26,108 lengths of bridge wire which have been compacted by a 1,000-ton squeeze. Several other tests are also being conducted on the cable sample, which is nearly 3 ft in diameter, 10 ft long, and weighs 15 tons. Four cables of this size, each about 7,000 ft long, will support the Narrows Bridge. The American Steel & Wire Division of U.S. Steel in Trenton will furnish over 30,000 tons of bridge wire for these suspension cables. The new bridge, to span New York Harbor between Brooklyn and Staten Island, will have a main span of 4,260 ft, edging out the Golden Gate Bridge as the world's longest single span.

Lake Washington Canal Bridge Nears Completion

This new dual truss-type bridge spanning the Lake Washington Ship Canal at Seattle is scheduled for completion by mid-summer. The $13,000,000 structure is a major link in the new 65-mile Seattle Freeway, connecting three cities in the Puget Sound area—Tacoma, Everett, and Seattle. The lower level is designed to carry four lanes of traffic, and the upper level eight. Overall length of the steel spans will be 2,293 ft. More than 11,400 tons of structural steel and over a million rivets will go into the structure. The steel was fabricated by Allied Structural Steel Companies, Chicago, and erected by the Industrial Construction Company, Minneapolis.

AGC Meeting Features Highway Panel

President Kennedy's Highway Program was on its way to Capitol Hill late in February as some 1,200 contractors, gathered in Boston for the 42nd annual meeting of the Associated General Contractors of America, heard four of the country's leading experts on highways discuss the outlook for 1961. Better times in 1961 were optimistically forecast by Rep. George H. Fallon, chairman of the House Subcommittee on Roads; Rep. Gordon H. Scherer, Ranking Minority Member of the House Subcommittee on Roads; Federal Highway Administrator Rex M. Whitton, F. ASCE; and A. E. Johnson, F. ASCE, executive secretary of AASHO.

The capacity audience heard Mr. Whitton describe the 60 percent of the Interstate Highway under way as consisting of 10,400 miles now in use, 4,100 miles under construction, and 10,000 miles for which right-of-way is being acquired for a total of 24,500 miles. In discussing the target date of 1972, Mr. Whitton stated that "it is just a matter of money." He also said that, while the federal government is paying 90 percent of the cost of the highway program, he did not feel that it was necessary for a Bureau of Public Roads man to be on each job in addition to the state highway representative.

In discussing the recent Congressional investigations of the highway industry, Representatives Fallon and Scherer joined in challenging the contractors to police their own industry more effectively and to build up the image of the program to the public through increased public relations on all levels—local, state, and federal. Representative Fallon expressed faith in the Highway Departments and stressed that the highway system is being built for double the current traffic rates. He also urged his audience to describe highway costs as cost per vehicle mile. This, he declared, is a more accurate and reliable figure than the straight cost per mile.

Asked about the Federal government's reimbursing states for toll roads incorporated into the Interstate System, Representative Scherer declared that this was not the time for such action. He said that perhaps a formula for reimbursement would be developed at a later date, but that to do so now would mean an additional $4 billion and serious consequences to the continuing program.

Mr. Johnson, in urging that the 90-10 formula for financing the Interstate system (the Federal government pays 90 percent and the state the remaining 10 percent) be continued, said that increasing the states' share would only mean more local taxes and a certain delay in the program. He also stated that he believed the Interstate System could be completed for the current $41 billion price tag by 1972.

In addition to the panel discussion on Highways, other sessions of the four-day (February 27 to March 2) meeting were devoted to Building Construction and Heavy Construction.

At the opening session of the four-day meeting, the contractors heard their own John A. Volpe, recently elected Governor of Massachusetts, outline a program to insure the continued good health of the construction industry. He stated the need for greater progress in working out ethical relationships between the general contractor and subcontractors through volunteer procedures. Safety and public relations were also described by the governor as fields of the construction industry in need of more attention. In closing, Governor Volpe urged his fellow contractors to participate more fully in the actual conduct of government.

A 1965 volume of new construction approaching $70 billion—some 25 percent above the 1959 record level was predicted by Secretary of Commerce Luther H. Hodges. Currently, the construction industry accounts for 15 percent of the nation's total economic output. He called for an increased on-site productivity rate for home construction and more research in the design of equipment and basic materials with emphasis on practical application.

AGC members do about 80 percent of all the building, highway, municipal and heavy construction work in the United States, and most of these attending the convention left with renewed faith that recovery in the construction industry—bolstered by urban renewal as well as the highway program—is on the way.

M. Clare Miller is AGC president

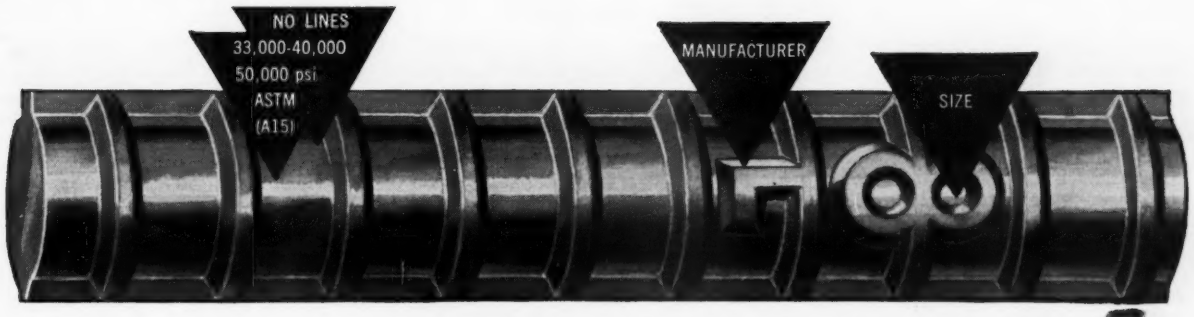
M. Clare Miller, a Kansas contractor and vice president of AGC for 1960, was installed as president of the nationwide organization for 1961. Mr. Miller had been serving as acting president for the latter part of 1960 while the then president, John A. Volpe, was campaigning as a candidate for governor of Massachusetts.

Melbourne to Build Large Cultural Center

Plans for a spectacular art gallery and cultural center project have been announced by the City of Melbourne, Australia. The project—to be built on a seven-acre site overlooking the city's famous Botanic Gardens—will consist of a complex of buildings for housing both the visual and performing arts. It will include a national gallery, an art school, two theaters, a concert auditorium, and underground parking facilities for 3,000 automobiles. A subway will connect the structures with installations in the Botanic Gardens.

The project will feature a massive, copper-sheathed stone and concrete spire. The 415-ft-high spire, the tallest structure in Australia, will taper to a slender shining shaft dominating the city skyline. The base of the spire will house the theaters and concert auditorium, a restaurant, and meeting rooms for cultural organizations.

The rectangular art gallery of local bluestone and copper is said to be the world's first gallery with "floating platform" floors. This type of construction will permit natural light to enter the



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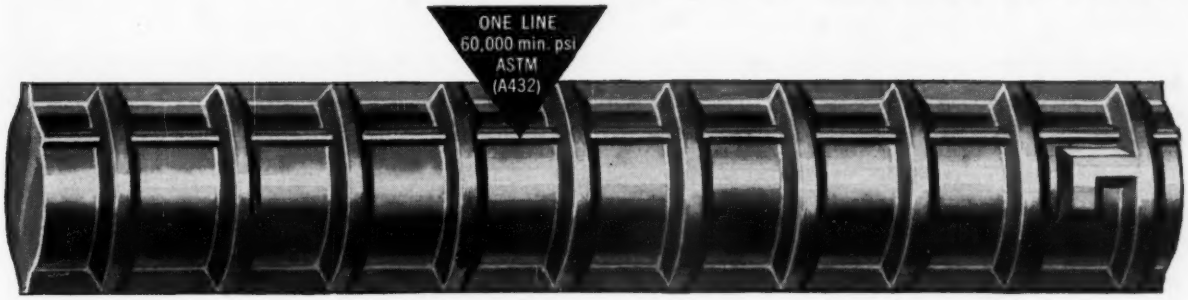
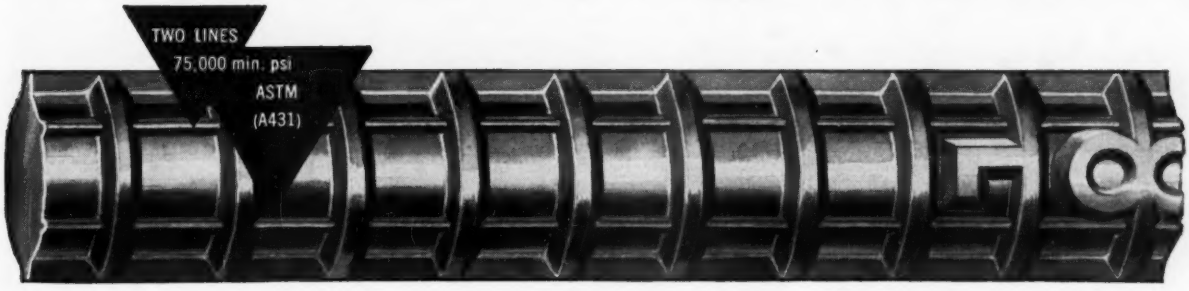


SHOW SIZE AND STRENGTH



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building from windows in the roof and at the top of the outside walls. A two-acre pool will completely surround the building.

Initial cost of the project is expected to be over $9,000,000, rising to $15,750,000 when the underground parking area and subways are added. Completion of the center is set for 1964.

Pollution Cleanup In Pennsylvania

More than thirty new sewage treatment plants were completed in Pennsylvania during 1960, and five others were rehabilitated. These accomplishments were revealed in a recent survey conducted by the Clean Streams Program. The survey also shows that, during the year, the Sanitary Water Board approved 327 permits for new sewage treatment plants and sewer extensions adequate to serve 796,307 persons.

Progress is also being made in the stream surveillance program, launched in 1959 to uncover new or previously unknown sources of water pollution. Almost every watershed in the state has been studied under this program.

Outstanding New Buildings Cited

A jury of prominent architects has selected seven recently completed buildings for the annual Honor Awards of the American Institute of Architects. According to the jury, these buildings "went far beyond mere competence and achieved true significance."

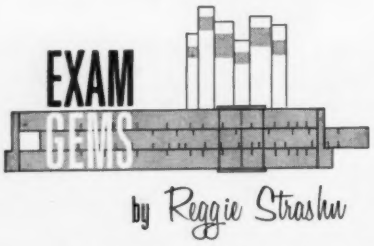
Winners of the AIA Honor Awards are the U.S. Embassy in New Delhi, India, by Edward D. Stone, of New York; the Shrine in New Harmony, Ind., and the Nuclear Reactor in Rehovot, Israel, both by Philip Johnson, of New York; Summer House in Northville, Mich., by Birkerts and Straub of Birmingham, Mich.; the Reynolds Metals Regional Sales Office Building in Detroit, by Minoru Yamasaki of Birmingham, Mich.; Fernando Rivera Elementary School, Daly City, Calif., by Mario J. Ciampi and Paul Reiter as Associated Architect of San Francisco, Calif.; and the Pepsi-Cola World Headquarters in New York by Skidmore Owings & Merrill, of New York.

World's Fair Plans Outlined to Engineers

Instead of setting up and maintaining an engineering staff of its own, the World's Fair Corporation plans to obtain most of its engineering services from existing firms and to have only a very small engineering staff. This was one of several disclosures made by Maj. Gen. W. E. Potter, F. ASCE (USA Ret.), executive vice president of the World's Fair Corporation, in a recent address before the American Institute of Consulting Engineers.

Total expenditures are expected to reach the billion-dollar mark, with the Fair Corporation's share estimated at $158 million. The many exhibitors are expected to expend half a billion dollars in construction and furnishing of their areas.

Major highway improvements are also part of the overall plan. These include widening Grand Central Parkway and the Whitestone Expressway, improvement of Northern Boulevard, and extension of the Van Wyck Expressway. These improvements will be financed by the Federal Government and the state. Approximately $700,000 will be contributed by the City of New York as its share of land acquisition costs for the Grand Central Parkway and Van Wyck Expressway projects.



R. ROBINSON ROWE, F. ASCE

A watertight box 6 ft square and 10 ft deep contains impervious particles whose bulk weight is 40 pcf, with a ratio of voids of 30 percent and standing to a depth of 3 ft. If the box is filled with water until the water is 5 ft deep, what is the pressure in psf on the bottom of the box?

The short text of Examgem 21 has been repeated to call attention to redundancy of some data and the importance of casual detail. For instance, many solutions computed total weight of box contents, including the factor 36, then divided by 36 to get the unit pressure!

It's simpler, of course, to work with a square-foot column. A typical solution added weights of particles, watered voids, and overlying water, viz:

	3 x 40	= 120
30 percent x	3 x 62.5	= 56
	2 x 62.5	= 125
Pressure		= 301 psf

When this was shown in a post-mortem seminar, a half-bright chap disputed the second item. "Ratio of voids," he said, "is not the percentage of bulk space, but of absolute volume of the solids. With 30 percent voids to 100 percent solids, the bulk space is 130 percent, so the volume of voids is 30/130 or 23 percent of bulk space. So the second item should be 43, and the unit pressure 288 psf."

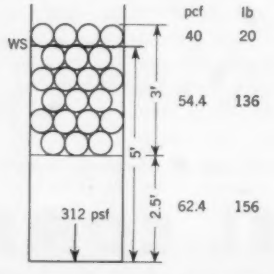


Fig. 1. Flotation of particles in square-foot column, showing unit and component weights.

But a full-bright scholar piped up to call the void ratio redundant, because the particles would float. Figuring hydrostatic pressure from the free-water surface, he found $p = 5 \times 62.4 = 312$ psf. He was right, and Fig. 1 shows how the mass of particles will rise 2.5 ft to float with its top 0.5 ft above the free-water surface. A few got this right answer in a wrong way, by analogy with pore pressure but overlooking flotation.

Reviewing redundancy, note that the problem gives 6 numerical factors and that only one, the depth of water, enters the calculation. However, others may be significant. If the 40 had been 70, or the 30 percent had been 60 percent, the particles wouldn't float, these figures would be used in the calculation, along with the 3-ft depth of particles. So only the 6 and 10 were truly redundant.

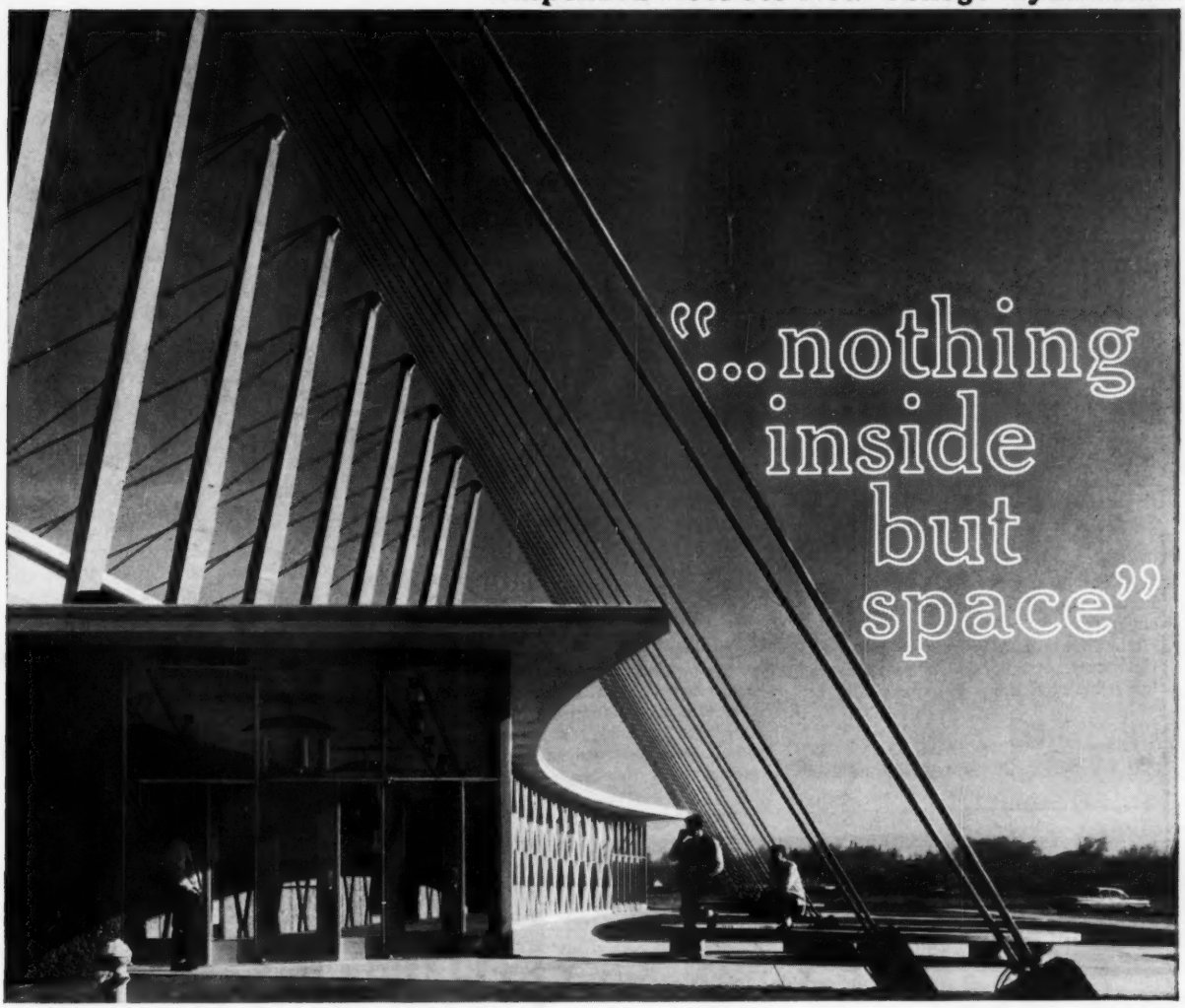
Now for casual detail, compare the "watertight" with "impervious." They are comparable adjectives and apparently casual details, but if the particles were not impervious, water might permeate them to prevent flotation. Hence "impervious" was necessary; were it absent, one should look for some correlative factor, like density or absorption.

Gem quality lay in the simplicity of solution for the thinking man and the penalty for boys with an eye only for figures which can be combined in some algorithmic process to get some kind of a quick answer. Variants of this set-up have been numerous. For example, those that flunked this one faced the following the next year.

EXAMGEM No. 22

A cylindrical tank made by welding a 7-ga bottom plate to a corrugated iron pipe 6 ft in diameter by 5 ft high is supported along its perimeter. Cast in the lower half of the tank is a mass of cemented gravel, weighing only 120 pcf, it being permeated by large connected voids or cells occupying 20 percent of the bulk volume and thru which water can pass freely. When the tank is filled with water, what is the unit pressure on the bottom of the tank at the center?

Suspended Roof for New College Gymnasium



"Column-free on the inside" is the way the architect describes this exciting and wholly utilitarian structure. It is the Physical Education Building of the Central Washington College of Education, Ellensburg, Washington. It is 150 ft wide by 390 ft long and contains, among other things, a main gymnasium, upper gymnasium, field house, swimming pool, apparatus room, two four-wall handball courts, two classrooms, 14 offices and, locker rooms, dressing rooms, etc.

The suspended roof is actually floating, being slip-fastened to the exterior walls. There are twenty-eight 80-ft high prestressed concrete pylons. Each supports two pairs of 1-5/16 in. prestretched, galvanized bridge strands, which suspend the entire roof structure. The 56 cables, averaging 404 ft in length, were prestretched and accurately marked for all attachment points at Roebling's plant. This resulted in an easy, economical field erection procedure.

Spectacular new Health and Physical Education Building, Central Washington College of Education at Ellensburg, Washington.
Architect: Ralph Burkhard, A.I.A., Seattle
Structural Engineers: Anderson, Birkeland, Anderson, Tacoma
General Contractor: Earley Construction Company, Tacoma
Prestressed Concrete Fabricator: Concrete Technology Corp., Tacoma

Its 99,500 sq ft of floor space cost $14.15 per sq ft, including architect's fee and 4% sales tax, which is below average for a building of this size.

These basic details are indicative of the wide and varied benefits common to all suspended roof structures. Airline terminals and hangars, plants, gymnasiums, civic auditoriums – all are enjoying the free space afforded by suspended roofs.

Roebling's great experience with steel in tension leads naturally to its active role in the suspended roof field. Our findings, theories and interest in its every phase are offered to you at any time. Should you wish further details on this particular structure, or information of any nature dealing with suspended roofs, please do not hesitate to write Roebling's Bridge Division, Trenton 2, New Jersey.

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DECEASED

Joseph Garfield Bastow (M. '50; F. '59), age 68, prior to his retirement last September, had been continuously employed by the Port of Oakland (Calif.) since 1926 in the various positions of structural designer, chief structural designer, assistant engineer, chief engineer, and assistant port manager in charge of engineering. In these positions he participated in the planning, designing and supervision of every major improvement constructed by the Port since its inception, such as the development of Metropolitan Oakland International Airport and Jack London Square, a major tourist attraction.

Robert Beatty (M. '58;F. '59), age 59, for the past three years had been a civil engineer for the Federal Housing and Home Finance Agency in Philadelphia. He joined the agency after 15 years with the Atlantic Refining Company.

Elroy W. Bentley (A.M. '32;M. '59), age 78, during 20 years with the New York State Department of Public Works, was in charge of construction of street and road work. In later years he constructed highways, streets, and public office and park facilities for numerous upstate New York communities. When he died recently, Mr. Bentley had an engineering and land surveying office at Glens Falls, N.Y.

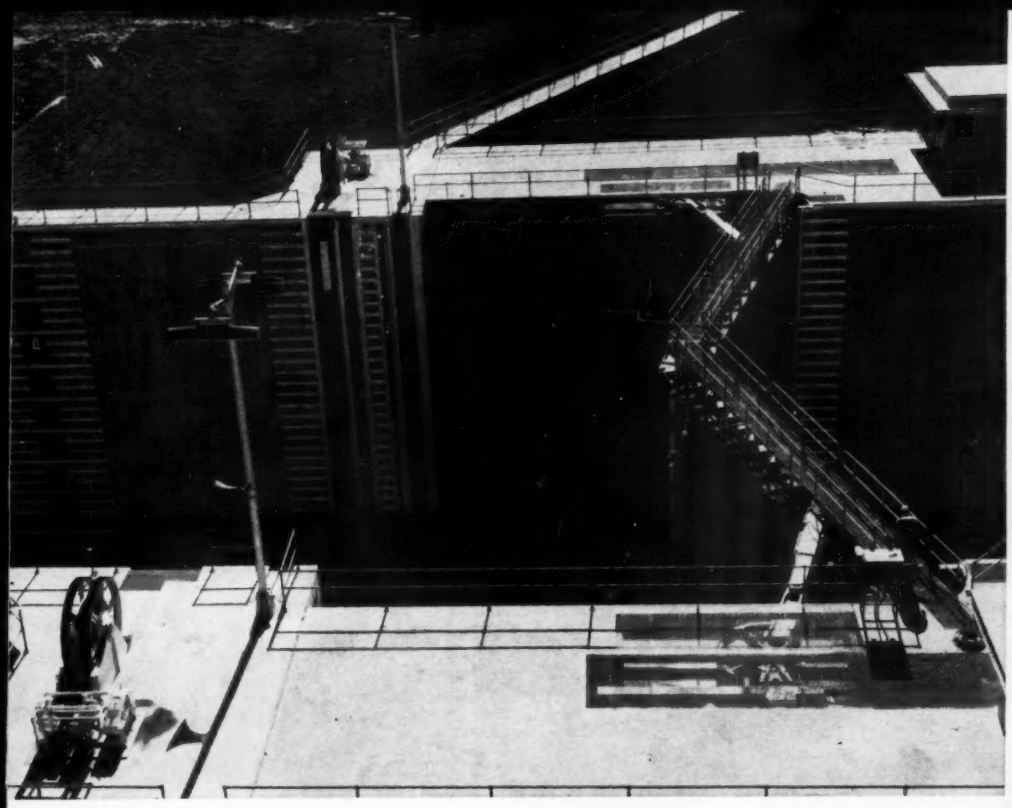
Thomas Berry (M. 08;F. '59), age 91, retired engineer of Sacramento, Calif. He graduated in 1885 from Gordons College, Aberdeen, Scotland. From 1929 to the 1940's he served as general manager of the Cal-Idaho Mining Company where he specialized in hydraulic engineering. Earlier, he was a consulting engineer to several light and power companies in Brazil; chief engineer of the American Beet Sugar Company in Colorado; and chief engineer and assistant manager of the Arkansas Valley Sugar Beet & Irrigated Land Company.

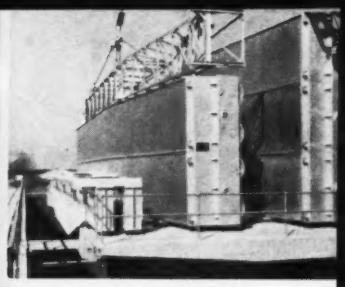
William G. Brenneke (M. '06; F. '59), age 90, retired as recently as 1945 as civil engineer with the State of Connecticut. After maintaining his own firm in St. Louis for 20 years, Mr. Brenneke, for another 40 years, engaged in extensive engineering in the New England area as resident engineer on the Charter Oak and Mt Hope bridges in Rhode Island, the New London-Groton Bridge across the Thames River in Connecticut, and as superintendent of construction at the Connecticut College for Women in New London.

Nathaniel A. Carle (M. '11;F. '59), age 85, who at one time was city engineer of Seattle, Wash., was one of the few engineers competent to practice in the diverse fields of civil, mechanical, electrical, and mining engineering. Mr. Carle's last position was as cost engineer with the Seattle firm of Siems, Drake.

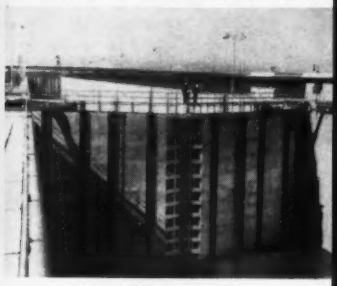
Charles Edward Cate (M. '32;F. '59), age 76, for nearly half a century—until the early 1950's, was actively engaged in engineering in Mexico, Guatemala and Honduras. For more than 30 of those years he served with the Southern Pacific Railroad Company of Mexico in various capacities, ranging from assistant superintendent of maintenance-of-way and structures to chief engineer. Then for five years each, he served with International Railways of Central America as engineer in the bridges and building division and as chief engineer of the Stand-

(Continued on page 98)

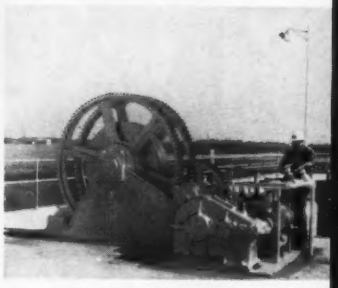




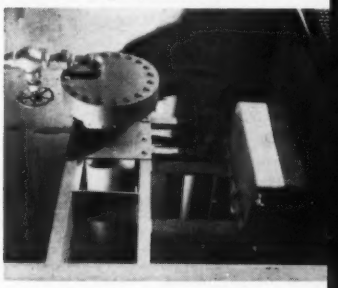
Emergency Bulkhead and Pickup Beam



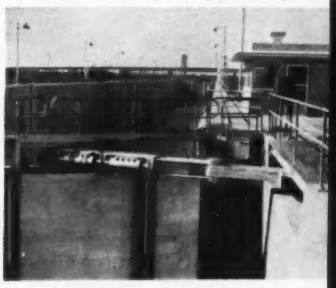
Lock Gates



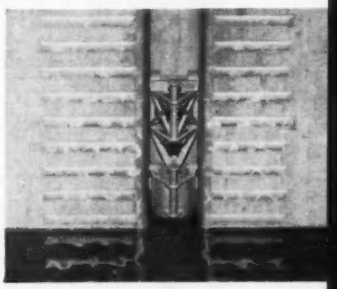
Emergency Bulkhead Hoist



Tainter Valve Operating Machinery



Miter Gate Operating Machinery



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ard Fruit Company, later the Standard Fruit and Steamship Company.

Sheldon Byrne Clement (M. '13;F. '59), age 80, served from 1906 to 1909 as assistant engineer and, from 1909 until 1945, as chief engineer of the Temiskarming & Northern Railway at Ontario, Canada. Before joining the railway company, he was briefly assistant engineer of the Hydro-Electric Power Company of Ontario.

Paul Cranston Erb (A.M. '58;M. '59), age 39, for the past year had served the community of Palos Verdes Estates, Calif., as city engineer and director of public works. Before that he was assistant city engineer of San Gabriel for three years, and hydraulic engineer with the California State Department of Water Resources for six years.

Bernard R. Fuller (M. '43;F. '59), age 72, at the time of his retirement in 1957, was working on the St. Lawrence Project. During some 50 years of engineering experience he worked on projects over much of the United States, Mexico and the Dominican Republic. His experience in the United States included ten years as an engineer with the Tennessee Valley Authority in Knoxville, another ten with the Corps of Engineers in western New York State, and from 1957 until his death, was retained by the Mid-South Engineering Company in Knoxville as a consulting engineer.

Rex H. Fulton (A.M. '43;M. '59), age 58, retired last December from the California Division of Highways after serving for a total of 30 years as a member of that state agency. He joined the Division in San Luis Obispo, transferring in 1933 to Sacramento, where for the past six years he had served as associate highway engineer in charge of aerial surveys.

Homer Johnston Gault (M. '07;F. '59), age 90, after a full professional career with the U.S. Bureau of Reclamation, had retired in 1934. In the early days when the Bureau was referred to as the Reclamation Service, Mr. Gault built several dams on the Rio Grande and nearly 100 miles of irrigation canals in the valley; finished construction of Salmon Lake Dam in Washington; served as consulting engineer for the Government of Mexico; and as senior engineer had charge of construction of Stony Gorge Dam in California and Cat Creek Dam in Nevada.

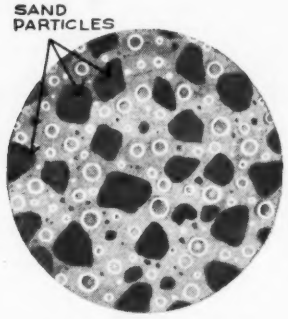
Maxwell Gibbs (M. '45;F. '59), age 67, at the time of his death recently, was owner of the Maxwell Gibbs Company in Beverly Hills, Calif. Very early in his career, Mr. Gibbs opened his own engineering and general contracting office which he maintained for most of his professional life. He took time out, however, in the 1940's, to serve with the Corps of Engineers in Honolulu and in the War Department as associate electrical engineer.

Richard F. Graef (M. '41;F. '59), age 57, most recently was vice president of

(Continued on page 100)

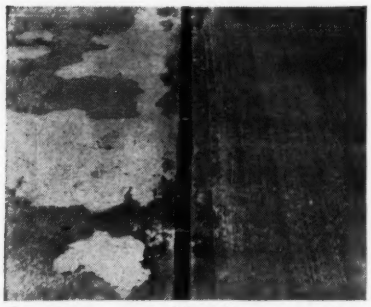
Where and How to Use Air-Entrained Concrete

Cement Plus Air



When an air-entraining admixture is introduced into a concrete mix it forms literally billions of tiny air bubbles. Air-entrainment was originally developed to make concrete more resistant to the harmful effects of freezing and thawing action. It also provides a number of desirable side effects. It is more cohesive and workable. It results in less bleeding or surface water; there is less danger of segregation and trapped air pockets and it has less tendency to dust when steel trowel finished.

Air-Entrainment Prevents Scaling



Concrete pavement subjected to severe weathering and frequent applications of salt. The unscaled pavement on the right of the expansion joint was built with air-entrained concrete. The heavily scaled pavement on the left was built with portland cement containing no air-entraining material.

During severe winters some concrete pavements have revealed surface scaling as a result of freezing and thawing and from the direct application of salt to remove ice. The extent of the scaling depends upon the amount and frequency of salt application and the quality and age of the pavement. Extensive laboratory research and field experiments show that concrete produced with air-entraining portland cement have excellent resistance to severe frost action and salt applications, provided salt is not applied too soon (never less than 6 weeks).

How Much Air

Best results with pavement mixes in which the maximum size of coarse aggregate is at least 1½ in. are obtained when the total air entrained in the concrete is as shown in the following table. For mixes in which the maximum size of coarse aggregate is less than 1½ in. the greater mortar content requires a somewhat higher total air content in the mortar.

Max. Coarse Aggregate	*Per Cent of Air*
1½ in.	5% ± 1%
¾ in.	6% ± 1%
⅜ in.	7½% ± 1%

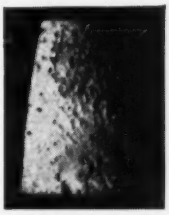
Where to Use Air-Entrained Concrete

In areas where severe frost action prevails or where repeated applications of de-icing agents are made, air-entrained concrete should by all means be used. Its excellent weathering qualities, increased cohesiveness and better workability make it decidedly superior for jobs such as concrete pavements, bridge floors, large garages, warehouse loading docks, etc.

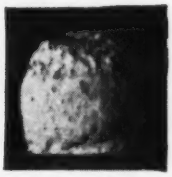
Mixing, Placing and Finishing

The mixing time for regular portland cement is also adequate for air-entrained cement. Inadequate mixing does not permit entrainment of sufficient air, and prolonged mixing may tend to decrease the entrained air. This makes it more important for the concrete user to be ready to place the concrete immediately after it has been mixed sufficiently to avoid prolonged mixing.

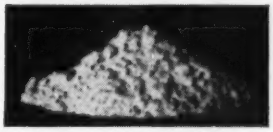
Air-entrained concrete can be readily handled and spread because the mix is very workable and cohesive, and is not apt to segregate. *Wheel, shovel or chute the mix into place, but do not flow.*



Good if vibration is used



Maximum slump



Too wet—will cause stickiness

Use a relatively dry mix with air-entrained concrete—not over a 4-inch slump on a *damp* sub-grade, and if vibration is used, the slump should not be over 1 inch. A dry mix is much easier to finish than a wet one.

Tips for Best Results

1. Be sure that air-entrained concrete is used on all exposed work where the job will be subject to freeze-thaw cycles. Air-entrainment is not a "cure-all", but is effective if the rules of good concreting are observed. It protects even some lean concrete against freeze-thaw damage.

2. Make sure that air-entrained concrete is at least 6 weeks old before subjected to salt or calcium chloride applications.

3. Be sure the air content of air-entrained concrete is sufficient (see table). If the air is too low, even air-entrained concrete can be damaged by freeze-thaw cycles—especially the first winter.

4. Encourage *closer* control of the slump for all work done in the late fall and winter—the sloppier the mix, the less effective the air-entrainment.

Reprints of the information on this page are yours for the asking.

the Baltimore firm of Knoerle, Graef, Bender & Associates, Inc., after an earlier seven year period as chief engineer of the H. K. Ferguson Company. Mr. Graef made notable contributions as one of the directors of design of the Illinois Toll Highway and as chief bridge engineer for the Pennsylvania Turnpike Commission during its first design stage (1938-1940).

Henry L. Gray (M. '12;F. '59), age 80, since 1913 had continuously carried on a private consulting practice that included engineering work for operating public utilities, investment houses, civic organizations and local, state, and Federal agencies and departments. Prior to 1913, he served as the first chief engineer of the Washington State Public Service Commision.

Nathaniel W. Hardy (A.M. '30;M. '59), age 71, was an architect and consulting engineer in Corpus Christi, Texas, for 30 years. As chief architect and associate architect for the U.S. Housing Authority on a project involving a total of 1,250 dwelling units, Mr. Hardy personally handled all electrical, mechanical, and site development work.

Bernard J. Hermes, Jr. (J.M. '56, A.M. '59), age 25, a 1956 civil engineering graduate of the Agricultural and Mechanical College of Texas, was killed while working on a California State highway project near Willits, Calif., in his capacity as project engineer-estimator for the Granite Construction Company. He had previously been employed in the engineering department of the United Fruit Company in Guatemala.

Ditlef Raeder Hettelsater (M. '47; F. '59), age 75, in recent years served as structural engineer with the Jones-Hettelsater Construction Company of Kansas City (now Weitz-Hettelsater Engineers). Earlier, he was structural engineer with the American Bridge Company, the Lackawanna Bridge Company, J. T. Ryerson & Son, and from 1932 to 1940, was construction engineer with the Freyn Engineering Company of Chicago.

Gloster P. Hevenor (M. '27;F. '59), age 72, five years ago formed the Deynor Corporation in Mamaroneck, N.Y., and, until his recent death, served as president and chairman of the board. Between the first phase of his career when he was assistant engineer with the City of Rochester, N.Y., and the last phase, Mr. Hevenor held several executive positions, including that of executive vice president of the Johnson March Corporation and president of the Aquadyne Corporation, both New York firms.

Daniel D. Johnson (A.M. '60), age 23, was manager of the bridge division of Johnson Bros., highway and heavy constructors of Minneapolis, Minn. Last year, just prior to graduating from the University of Colorado, he received the Colorado Section's outstanding senior award.

Word Leigh (M. '20;F. '59), age 84, prior to his retirement several years ago had been manager of the Mexican facilities of the Worthington Pump and Machinery Corporation of New York. In the 1920's he was sales engineer for several companies in Shanghai, China and, from 1905 to 1914, held various positions with the Robins Conveying Belt Company, including that of assistant sales manager.

Edward A. Lejeck (M. '59;F. '59), age 52, served as structural engineer with several Chicago firms before joining Koppers Company, Inc., of Pittsburgh, in 1950. In the decade since, he had been employed as manager of the firm's structural branch; as chief draftsman and manager of the design department; and, most recently, as manager of the Metallurgical Section.

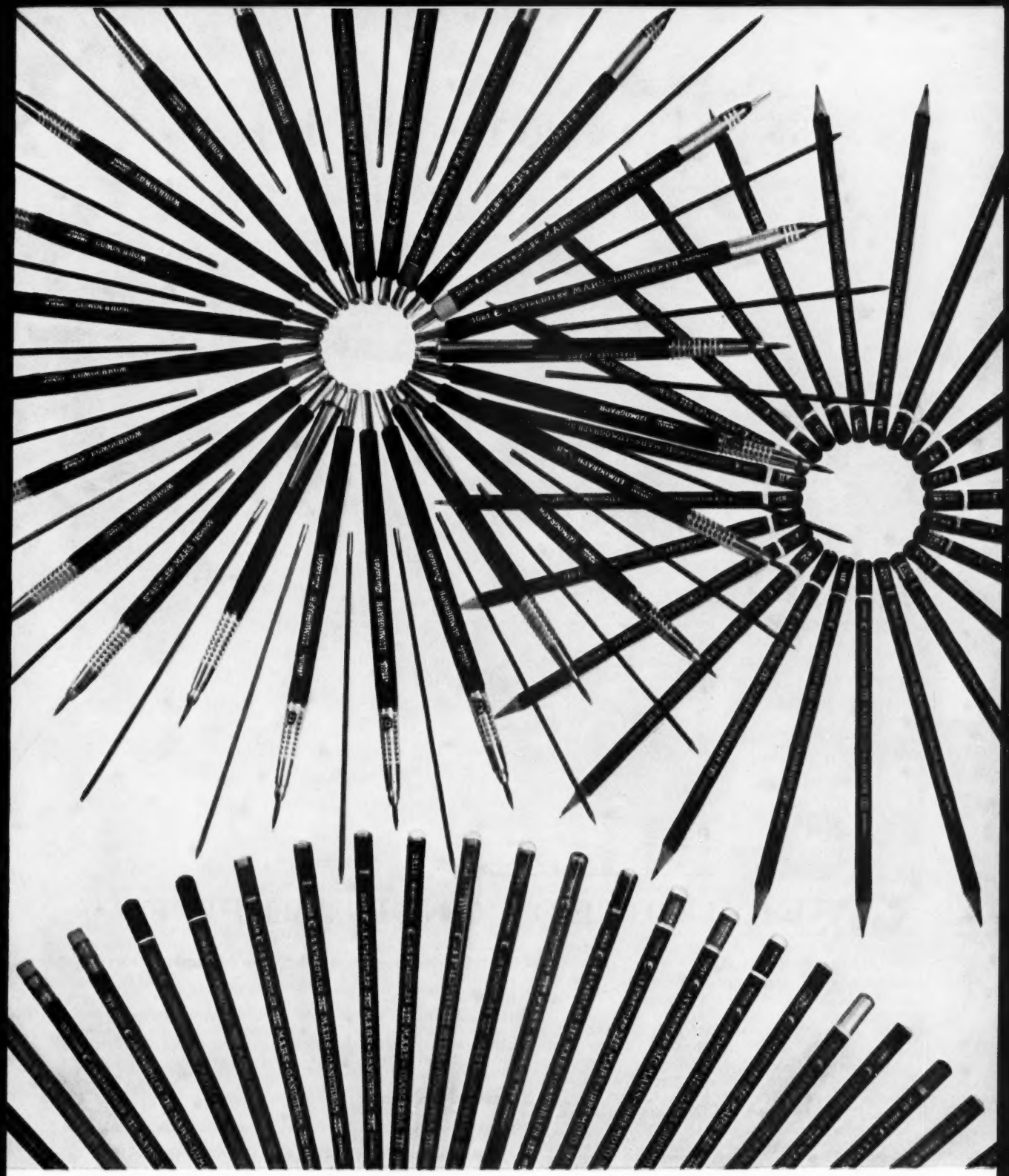
Hsin-Kuan Liu (A.M. '56;M. '59), age 38, joined the engineering staff at the Colorado Agricultural and Mechanical College at Fort Collins, Colo., in 1955 as an assistant professor. Although he taught courses in engineering mechanics and hydraulics of open channel flow, Professor Liu's chief preoccupation was research. Born in China he received a B.S. in hydraulic engineering from the National Northwestern College of Engineering there, prior to attending the State University of Iowa where he received an M.S. in hydraulics in 1949, followed in 1953 by a Ph.D. in civil engineering from the University of Michigan.

John Howard Mayer (M. '28;F. '59), age 74, as chief engineer with the Alabama Asphaltic Limestone Company since 1928, had charge of plant operations, laboratory research, specifications and general supervision of paving. His earlier experience included service as division engineer of the Alabama Highway Department; as assistant city engineer of Birmingham, Ala., and as assistant county sanitary engineer of Jefferson County.

James Newton Sligar, Jr. (A.M. '50;M. '59), age 45, a consulting engineer of Fort Worth, Texas, had previously been employed by the Texas State Highway Department.

Milton J. Strong (Aff. '28), age 67, from 1914 to 1940 was associated with the Penrose interests in Colorado. He was given full responsibility in the 1920's as superintendent of construction and maintenance on such projects as the Will Rogers Stadium and Shrine; the Ice Palace, and the Lodge on the summit of Cheyenne Mountain, including the water and sewage system. In recent years he was chief engineer of the Broadmoor Hotel and Associated Company, in Colorado Springs.

[*Editor's Note:* W. Sherman Smith, M.ASCE, who was assistant dean of the College of Engineering at the University of Toledo, in Toledo, Ohio, died recently. Through an error that is much regretted he was incorrectly listed as assistant dean of the College of Engineering at Ohio State University in the March issue.]



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RECENT BOOKS

(added to the Engineering Societies Library)

Concrete Engineering Handbook

This collection of fundamental and practical design and construction information compiled by twenty specialists, who assumed prior knowledge of structural mechanics and of reinforced concrete in preparing their contributions, includes design methods for various types of structures, special resumes on structural theory, torsion, materials, and construction methods, techniques for the design of chimneys, storage bins, pavements, bridges, and skin structures, and special topics such as applications of prestressed concrete, and the handling of building-frame deflections caused by earthquake forces. Included also are such design aids as diagrams and tables. (By William S. LaLonde, Jr. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., 1961. Various pagings, bound. $25.00.)

Creative Engineering Design

This book whimsically draws on an intriguing variety of sources, from "Machine Design" to the "Saturday Evening Post", and "Alice in Wonderland" for quotations and cartoons to support the sound suggestions and techniques presented. The author in carrying out the aim of the book to develop in the reader a capacity to design, makes a keen analysis of the particular challenge to imagination and creativity which distinguishes design problems from other engineering problems, describing various steps in the process of creative design, from recognition and definition of the problem to evaluation and presentation of the solution. Somewhat of a "popularization", with an unusual format, this book offers a stimulating and refreshing viewpoint. (By Harold R. Buhl. Iowa State University Press, Press Building, Ames, Iowa, 1961. 195 pp., bound. $3.95.)

Digital Computer and Control Engineering

This comprehensive elementary engineering textbook presents the major aspects of digital computers and controls for the student engineer. The first part covers general concepts of programming applicable to any computer, and concludes with an exposition of the International Algebraic Language ALGOL. Digital systems design based on numerical analysis and data processing, and logical design of digital circuits utilizing 'designation numbers' and applied to all types of arithmetic compounds, are developed and explained. The final part deals with the electronic design of digital circuits, utilizing solid-state and magnetic core components. (By Robert Steven Ledley. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., 1960. 835 pp., bound. $14.50.)

Die Eigenschaften Des Betons
Second Edition

A systematic presentation of the properties of concrete, dealing with test results and observations on cements, aggregates, concrete, and special concretes under a variety of physical conditions. Special sections are devoted to various types of light-weight concrete, and some tests are briefly described. (By Otto Graf. Springer-Verlag, Berlin, Germany, 1960. 346 pp., bound. DM 52.50.)

Higher Plane Curves
Third Edition

A reprint of the third edition (1879) of an enduring treatise on the theory of curves, which deals with coordinates, general properties of algebraic curves, envelopes, metrical properties, cubics, quartics, transcendental curves, transformation of curves, and the general theory of curves. The author, then with the University of Dublin, properly acknowledges the lengthy contributions of Professor Arthur Cayley, then of the University of Cambridge. (By George Salmon. Chelsea Publishing Company, 50 East Fordham Road, New York 68, N. Y., 1960. 395 pp., bound. $4.95.)

Irrigation and Hydraulic Design
Volume 3: Hydraulic Structures for Irrigation and Other Purposes

The first two volumes of this work dealt with general principles of hydraulic design (1955), and specific design methods and theory for irrigation works (1957). This third and final volume deals with multiple-purpose hydraulic structures, such as the various types of headworks on alluvial rivers, from the standpoints of design, execution and economics, as well as with the electrification of existing headworks, and the hydraulic power stations in general, navigation locks, arches, dams, and so on. (By Serge Leliavsky. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1960. 765 pp., bound. $60.00.)

It's The Law!

Based on a monthly column written by Judge Tomson over a period of years for "Progressive Architecture", this book aims to furnish to the architect, engineer, and contractor a basic appreciation of some of the more important legal problems with which they may become involved. It furnishes the answers to some specific legal questions, contains a special section of standard legal forms, and discusses statutes regulating professional practice, organization and business problems, employment relations, rights and liabilities, and restrictions upon the use of property. There is also a useful index of cases cited throughout the text. (By Bernard Tomson. Channel Press, Great Neck, N. Y., 1960. 436 pp., bound. $7.50.)

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Methods of Regional Analysis

This volume presents some operational and some untested techniques for the analysis of geographical regions, as used in regional science. These techniques will supplement the general theory developed in the author's previous volume, "Location and Space Economy". Engineers will be interested chiefly in those operational techniques dealing with industrial location, land use, and urban structure, and such newly-developed but untested techniques as interregional linear programming, and gravity, potential and spatial models. (By Walter Isard. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1960. 784 pp., bound. $9.50.)

Ruttelbeton
Third Edition

A study on vibrated concrete and on the applications of vibrators. Separate chapters are devoted to vibration operations common to all types of vibration compression, the composition of vibrated concrete, the use of both submerged and surface vibrators, etc. Attention is also paid to working methods for achieving a complete adhesion in reinforcing hardened concrete, and to special fields of application. There is an extensive bibliography of some 270 German and English references. (By Kurt Walz. Verlag von Wilhelm Ernst & Sohn, Berlin, Germany, 1960. 168 pp., paper. DM 16.80.)

Symposium on Treated Wood for Marine Use

This volume contains the seven papers presented at the Third Pacific Area National Meeting

(Continued on page 112)

101 Buildings Studied

Hope-Witheron Building, San Diego
Towne House, Harrisburg, Pa.
Thomas Jefferson Bldg., St. Louis
Plaza Apartment Bldg. No. 10, St. Louis
Plaza Apartment Bldg. No. 20, St. Louis
Plaza Apartment Bldg. No. 30, St. Louis
Plaza Apartment Bldg. No. 40, St. Louis
Plaza Apartment Bldg. No. 50, St. Louis
Plaza Apartment Bldg. No. 60, St. Louis
1221 Minor Building, Seattle
Manhattan Bldg., Seattle
Logan Bldg., Seattle
Mark 51 Bldg., Seattle
Carlton House, Shaker Heights, Ohio
Broadway & Austin Bldg., San Antonio
215 N. Flores Bldg., San Antonio
Bayview Office Bldg. Addn., Ft. Lauderdale
Versailles Apartments, Ft. Lauderdale, Fla.
Birch Towers, Ft. Lauderdale
Breakwater Towers, Ft. Lauderdale
Massachusetts Blue Cross, Boston
Crimson Associates Bldg., Cambridge, Mass.
Babson Bldg., Boston
University Towers, New Haven
Woodland Medical Center, Hartford, Conn.
Strawberry Hill Terrace, Stamford, Conn.
1720 West End Bldg., Nashville
Park Towers, Baltimore
Hood-Hall Bldg., Dallas
Continental Apartments, Dallas
Empire Bldg., Salt Lake City
Dunleith Manor, Kansas City, Mo.
Quality Hill Towers Bldg., 910 Kansas City, Mo.
Old Security Life Ins. Bldg., Kansas City, Mo.
Fidelity Bldg., Indianapolis
Grain Dealers Mutual Ins. Co., Indianapolis
St. Paul Fire & Marine Insurance Co., St. Paul
Cheeseman Towers Apartments, Denver
777 Grant Bldg., Denver
Bankers Union Life Bldg., Denver
1710 "H" Street, Washington
1901 Pennsylvania Ave., Washington
Mercury Bldg., Washington
Premier Bldg., Washington
R. C. A. Bldg., Washington
Bender Bldg., Washington
Potomac Towers, Arlington, Va.
3900 Watson Place, Bldg. A., Washington
3900 Watson Place, Bldg. B., Washington
Railway Labor Building, Washington
City Bldg., Washington
Whispering Waters, St. Petersburg, Fla.
Union Bank Bldg., Beverly Hills, Calif.
Independence Life Insurance Bldg., Pasadena
Cornelius Plaza, Portland, Ore.
Park Vista, Portland, Ore.
Bernard Horn Bldg., Cincinnati
2300 Luray Bldg., Cincinnati
Liberty Mutual Ins. Bldg., Boston
Cornet Bldg., Clayton, Mo.
Maylee Bldg., Cleveland Heights
National Cash Register Bldg., Cleveland
The Diplomat, Shaker Heights, Ohio
1674 Meridian Bldg., Miami Beach
1919 Bay Drive Bldg., Miami Beach
Southgate Towers, Miami Beach
Hartford Federal Savings & Loan, Hartford, Conn.
Gateway Center No. 4, Pittsburgh
Medical Center Office Bldg., Pittsburgh
Blue Cross Bldg., Dallas
Vaughn Bldg., Dallas
Presidential Apartments, Chicago
Calhoun Terrace Apartments, Minneapolis
Imperial Apartment Hotel, Denver
Park Adams, North Arlington, Va.
First Federal Savings & Loan, St. Petersburg
Western Geophysical Bldg., Los Angeles
Signal Oil Bldg., Los Angeles
California Bank Bldg., Los Angeles
Pacific Fidelity Life Insurance, Los Angeles
Ohio River Vista Apartments, Cincinnati
411 Oak Bldg., Cincinnati
Winebrenner Haven, Findlay, Ohio
College Terrace, Brooklyn
45 E. 72nd St., New York
Bankers Trust Bldg., New York City
201 E. 15th St., New York City
The Park East, New York City
IBM Bldg., Detroit
1st Ave. & 56th St., New York City
1733-49 E. 12th St., Brooklyn
Ocean Towers, Brooklyn
Ocean Terrace, Brooklyn
345 Webster Ave., Brooklyn
American Field Service Bldg., New York City
140 E. 44th St., New York City
165 E. 72nd St., New York City
Fieldstone Dale, New York City
Bolton Manor, New York City
300 E. 51st St., New York City
30 West Broadway, New York City

National Study of 101 new Buildings reveals definite superiority of Structural Steel

Impartially selected, 43 of the studied buildings are framed in structural steel, 58 are reinforced with steel

Here are the results . . .

Speed— Buildings framed in structural steel went up 45% faster. From ground breaking to occupancy, buildings framed in structural steel progressed at the rate of 123,241* cu. ft. per month, compared with 85,240* cu. ft. per month for structures reinforced with steel. (Structural steel's greater speed was substantial regardless of project size.)

Cost— Almost identical, regardless of framing material. Buildings framed in structural steel averaged $1.54 per cu. ft., compared with $1.48 per cu. ft. for buildings reinforced with steel, an apparent 4% premium for structural steel. However, steel-framed buildings were 95.6% air-conditioned, as against 78.1% for steel-reinforced buildings. With air conditioning amounting to an average of 6% of total building cost today, simple calculation reduces the differential to 2.9%, which is offset by the revenue produced by earlier occupancy of steel-framed structures. (Average annual rental rate for these buildings was $3.88 per sq. ft.)

Conclusions? Draw your own.

Study Specifications:

All building foundations were begun after Jan. 1, 1958. All buildings were occupied before Nov. 30, 1960. Buildings ranged in height from 4 to 21 stories. (59 from 4 to 9 stories, 29 from 10 to 15 stories and 13 from 16 to 21 stories.) Office and apartment buildings, selected at random and located in all parts of the country, were studied by impartial construction survey specialists. None of the projects involved abnormal delays beyond the control of the contractor.

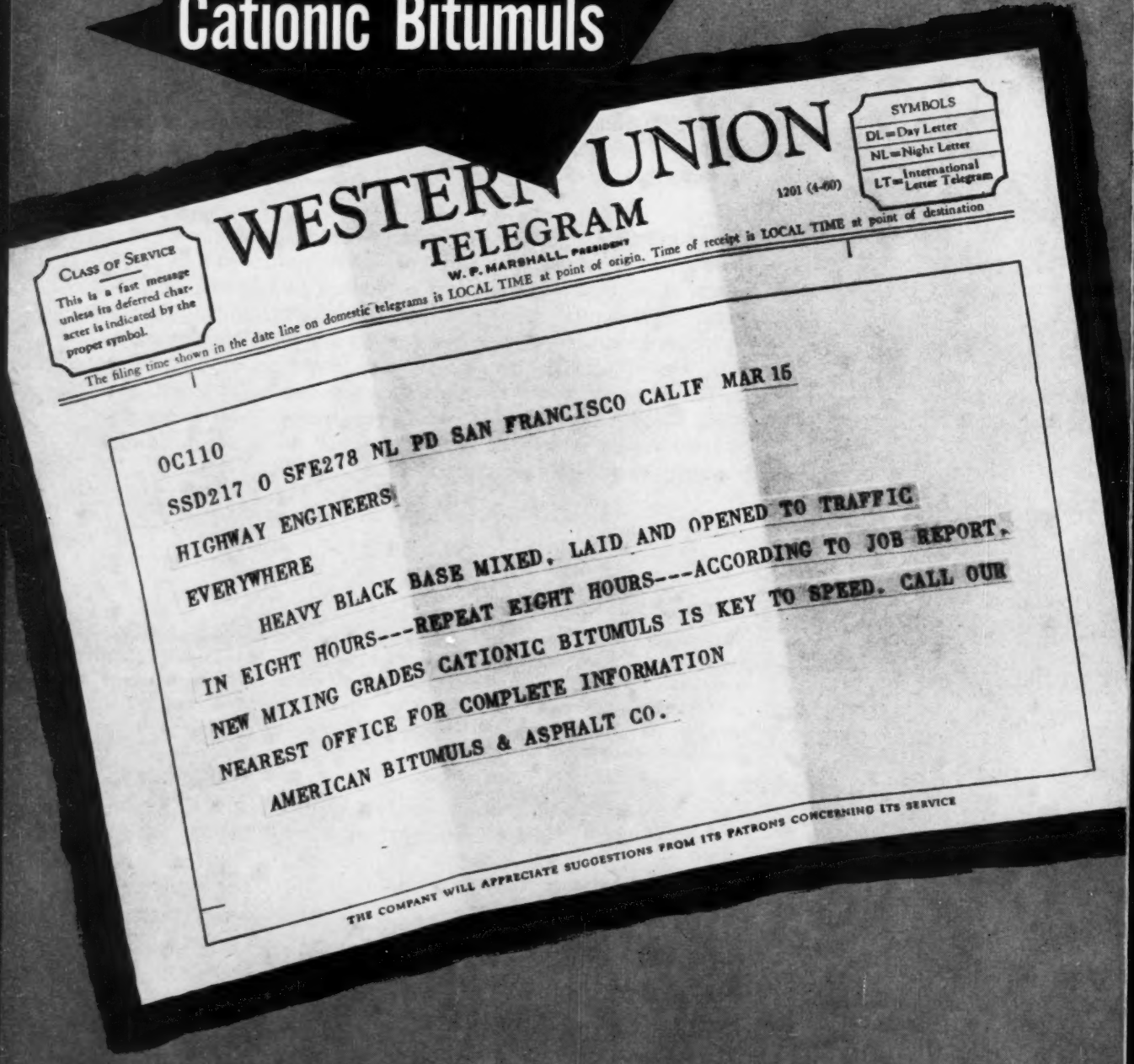
For more details on this study, write to American Bridge Division, U. S. Steel, Room 1801M, 525 William Penn Place, Pittsburgh 30, Pa.

*Applies to total construction time, not simply frame.

American Bridge Division of United States Steel

IT'S NEWS!

The New Mixing Grades Cationic Bitumuls



WESTERN UNION

TELEGRAM

W. P. MARSHALL, PRESIDENT

1201 (4-60)

SYMBOLS
DL = Day Letter
NL = Night Letter
LT = International Letter Telegram

CLASS OF SERVICE
This is a fast message unless its deferred character is indicated by the proper symbol.

The filing time shown in the date line on domestic telegrams is LOCAL TIME at point of origin. Time of receipt is LOCAL TIME at point of destination

OC110
SSD217 O SFE278 NL PD SAN FRANCISCO CALIF MAR 15
HIGHWAY ENGINEERS
EVERYWHERE
HEAVY BLACK BASE MIXED, LAID AND OPENED TO TRAFFIC
IN EIGHT HOURS---REPEAT EIGHT HOURS---ACCORDING TO JOB REPORT,
NEW MIXING GRADES CATIONIC BITUMULS IS KEY TO SPEED. CALL OUR
NEAREST OFFICE FOR COMPLETE INFORMATION
AMERICAN BITUMULS & ASPHALT CO.

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

Daily Construction Journal

NEW MIXING GRADES CATIONIC BITUMULS CUTS HOURS FROM ROAD BASE JOBS

Nationwide Reports Stress Speed of Construction

Base mix cures fast, permits rapid compaction after blading.

Contractor Terms It "Instant Paving"

SAN FRANCISCO, CALIF.—Job reports on base construction using the new Mixing Grades Cationic Bitumuls have now been received here at company headquarters from jobs nationwide.

Initial reaction among engineers and contractors connected with these jobs has been surprisingly uniform: all are impressed with the speed and ease of base construction using this new material. One contractor is reported to have used the term "Instant Paving" when referring to the base mix prepared with the new Mixing Grades Cationic Bitumuls.

This new product, developed by American Bitumuls & Asphalt Company, readily coats a wide range of aggregates—including many that are normallly considered "difficult". The mix is prepared in simple, high-capacity equipment, and can be spread and compacted immediately. There is no delay for aeration.

"BETTER ROADS, FASTER"

Company engineers sum up the advantages of Mixing Grades Cationic Bitumuls in these few words: "Gives you better roads, faster." Every job report to date bears out this brief statement. Such terms as "better adhesion in the presence of water"; "improved early cohesion of the compacted mixes"; "better mixing properties due to fluidity", are frequently used in these reports as reasons for faster, better road construction.

Company Offers Data On New Mixing Grades Cationic Bitumuls

American Bitumuls & Asphalt Co. will welcome inquiries regarding the new Mixing Grades Cationic Bitumuls. Information on this new material is available from the locations shown, right.

Drag Strip Built in Five Working Days

PANAMA CITY, FLA.—The rapid mixing and placement of a sand mix base, stabilized with new Mixing Grades Cationic Bitumuls, was credited with speedy construction of an automotive drag strip near here recently.

The installation, a private project, was started on Wednesday. Preliminary clearing and grading were followed immediately with the mixing operation. Using a travel mixer, windrows of native sand were treated with new Mixing Grade Cationic Bitumuls; the mix was spread, compacted and opened to construction traffic immediately. On Friday, just two days later, this base was given a conventional sand seal and the strip was ready for operation.

Contractors on the job were reported as "impressed" with the ease and speed of the operation; and with the fact that occasional showers during the base mixing operation had no visible effect on the quality of the mix.

Laboratory Wash-Tests Prove Early Set Of New Mixing Grades Cationic Bitumuls

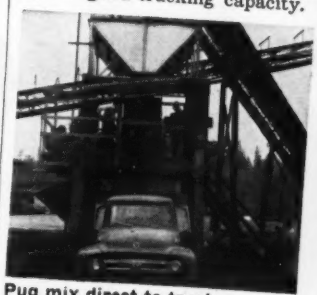
These two photos taken in the laboratory of American Bitumuls & Asphalt Co., demonstrate the "holding power" of the new Mixing Grades Cationic Bitumuls.

In the above photos you see the results of this test: the stone coated with the anionic binder is on the left; that coated with the Cationic binder on the right. Note the complete coverage maintained by the Mixing Grade Cationic Bitumuls.

Cuts Traffic Tie-Up With Quick-Set Mix

EUGENE, ORE.—On a short, heavily-traveled section of a major highway outside of Eugene, Oregon, engineers specified construction of a four-lane divided pavement with a minimum of traffic tie-up. They authorized the contractor, Wildish Construction Company, to use the new Mixing Grades Cationic Bitumuls for quick-setting Black Base construction that could be opened to traffic before it was surfaced.

Using a good quality graded aggregate (100% passing ¾"; 5% passing #200 mesh) the contractor prepared the base mix in a central plant using a simple pug mill. Rate of mix production (about 400 tons/hr.) was limited by assigned trucking capacity.



Pug mix direct to truck

The cold-prepared mix was trucked to the job in a fleet of bottom-dumps; bladed to grade; then compacted. It was opened to traffic the following morning while work was continued on the lanes across the dividing strip.

In reporting on the job, the Project Engineer stressed the good workability of the Cationic mix, plus the speed and ease of lay-down.

Cationic Bitumuls Stockpile Mix

Development of the new Mixing Grades Cationic Bitumuls has made possible, in some areas, the production of a patching and maintenance mix that can be prepared in advance; stockpiled until needed. The new Stockpile Mix retains good workability yet sets up readily after placement and compaction under traffic. This mix uses selected graded aggregates. Details are available from Company headquarters.

Applications for Admission to ASCE, January 28-February 25, 1961

Applying for Member

ERWIN ABONYI, New York, N.Y.
SURESH CHAND AGARWALA, Saharanpur, U.P., India
GOSTA THEODOR ALM, Stockholm, Sweden
JOSEPH RAMON AZOLA, Chicago, Ill.
STEWARD HALL BEALL, Washington, D.C.
ANTHONY CHARLES GEORGE BETTS, Montreal, Canada
OTOMARS BIKSA, Chicago, Ill.
PETER EDWIN EDELSTEN BRAY, New York, N.Y.
GEORGE GEOFFREY BROWN, Pahang, Malaya
ROBERT OTTO BURGEMEESTRE, Washington, D.C.
RAY EDGAR BURK, Houston, Texas
ALFRED STANLEY BURNEY, Ardsley, N.Y.
PETER CALLEJAS, Boston, Mass.
WILLIAM ROBERT CARTER, Fayetteville, Tenn.
TSIN-SIANG CHIA, Taiwan, China
STANLEY LENARD CLEWETT, Pittsburgh, Pa.
PHILIP COHEN, Johannesburg, South Africa
ROBERT NELSON CREWS, New Orleans, La.
WALTER ROBERT DAHL, New York, N.Y.
RONALD ALBIN DAHLIN, San Diego, Calif.
EDWARD JAMES DAVIES, West Lafayette, Ind.
GERALD LLOYD DRAKE, Columbia, S.C.
GORDON CHARLES EDWARDS, San Mateo, Calif.
RAYMOND LESTER ELDER, Kansas City, Mo.
EMERY LESLIE FICZERE, Tacoma, Wash.
JOE CURTIS FITZ, Oklahoma City, Okla.
CESAR NICOLAS FOROS, Alexandria, Egypt
WILLIAM KAZUYOSHI FUKUTAKI, Los Angeles, Calif.
KENNETH GIDDINGS, Ontario, Canada
CARLOS EDUARDO GONZALEZ CARRERA, Caracas, Venezuela
EUGENE B. HAMLIN, Boise, Idaho
ROBERT DAVID HAMPTON, Niagara Falls, N.Y.
JOSEPH HENRY HARGIS, Oklahoma City, Okla.
MARTIN HAUPTMAN, New York, N.Y.
RICHARD PAUL HERRITY, Clinton, Iowa
DONALD MYRON HOFFMAN, New York, N.Y.
CHARLES HENRY HOHENSTEIN, Syracuse, N.Y.
JOHN ALEXANDER HOLSCLAW, South Charleston, W. Va.
WILLIAM LLOYD HORSTMAN, Pittsburgh, Pa.
DONALD LESTER JARBOE, Topeka, Kans.
NORMAN LORD JOSE, Augusta, Me.
HIMMAT VILLAMJI KARIA, Pondicherry, India
WILLIAM BARTON KAYS, Whittier, Calif.
THOMAS ARTHUR KING, Warrensberg, Mo.
GEORG KLATTE, St. Louis, Mo.
LOUIS ANDREW KOFFMAN, Falls Church, Va.
PAUL KOWALCHIK, Balboa Heights, Canal Zone
NICHOLAS H. KUEHN, JR., Chicago, Ill.
SVEN LENNART RAHM, Goteborg S, Sweden
ROBERT BURNEY LONG, JR., Juneau, Alaska
ROBERT CULBERT LINTHICUM, Baltimore, Md.
WILLIAM JUDSON LOCKE, Pittsburgh, Pa.
FORTUNATO JOSEPH MAIOLO, Rome, Italy
SAMUEL ALLEN MARSHALL, JR., Albany, N.Y.
TOSHIO MAYEDA, Los Angeles, Calif.
WILLIAM DOUGLAS MCLEAN, New York, N.Y.
JACK MESHULAM, New York, N.Y.
ROBERT LEIGHTON NICHOLS, Fort Worth, Texas
KARTIK ORAON, London N.W., England
STEPHEN PANCIO, Rochester, N.Y.
PLINIO PATRAO, Cali, Colombia
RAMACHANDRAN PITCHAI, Bombay, India
TELMO PONCE G., Quito, Ecuador
RICHARD KEILER PULLING, Chicago, Ill.
CARL FREDERICK PURTZ, Columbus, Ohio
ROBERT ELWOOD RAPP, New York, N.Y.
PETER HUGHES RITCHIE, New York, N.Y.
WILLIAM STUART ROBERTSON, Winnipeg, Manitoba, Canada
JOSEPH COOK RODGERS, Rockville, Md.
MELCHOR RODRIGUEZ CABALLERO, Mexico, D.F., Mexico
ELLIS POLLICK ROOT, Lutherville, Md.
WILLIAM ALFRED SALMOND, Newark, N.J.
CHARLES EDWIN SAMPSON, Columbia, S.C.
BELLUR MYLARIAH SATYANARAYAN, Lucknow, India
PHILLIP NEGLEY SCHAEFFER, Dayton, Ohio
LUCIEN ANDRE SCHMIT, Cleveland, Ohio
WALTER BURNS SHAW, Chicago, Ill.
CALVIN ARTHUR SHOUP, Amarillo, Texas
SAJJAN SINGH SIDHU, Punjab, India
RALPH BERRY SIMS, London, England
CARL EDWARD SNYDER, Dayton, Ohio
WILLIAM KENNETH STOCKDALE, Washington, D.C.
WILLIAM AUGUST SUPP, Baltimore, Md.
JAMES MICHAEL USHER, Ogden, Utah
JOHN RUSSELL VAN NORT, Gary, Ind.
EARL WILLIAM WALDEMARSON, Erie, Pa.
MARVIN ELSWORTH WARNER, New York, N.Y.
ALVIN AUGUST WEHRMAN, Dallas, Texas
RONALD JOSEPH WELCH, Los Angeles, Calif.

(Continued on page 112)

Memo to Highway Engineers:

Re: AASHO Road Test

REQUEST FROM AMERICAN ASSOCIATION
OF STATE HIGHWAY OFFICIALS

Officers of the American Association of State Highway Officials (AASHO), the sponsor of the Road Test research project at Ottawa, Illinois, have expressed their hope that neither the Asphalt nor the portland cement industry will draw conclusions from the project ahead of the completion of the analysis of data and the interpretation of such data into final reports.

AASHO officers state that they do not believe any conclusions can properly be drawn at this time.

Moreover, these officers charge that any action to read premature findings from the project tends to reduce the public benefits from the expenditure of rather large amounts of public funds which went into the test.

Specifically, these AASHO officers have requested that AASHO's name not be used in any advertisements purporting to give results of the Road Test ahead of final reports because such use might convey the impression to the public that AASHO endorses the advertising.

This request from AASHO officers was directed to the portland cement and Asphalt industries on March 1, 1961.

THE INTENT OF THE AASHO ROAD TEST

The Official Statement of the Highway Research Board*
which Administers and Directs the Test:

The AASHO Road Test plays a role in the total engineering and economic process of providing highways for the nation. It is important that this role be understood.

The Road Test is composed of separate major experiments, one relating to asphalt concrete pavement, one relating to portland cement concrete pavement, and one to short span bridges. There are numerous secondary experiments. In each of the major experiments, the objective is to relate design to performance under controlled loading conditions.

In the asphalt concrete and portland cement concrete experiments some of the pavement test sections are underdesigned and others overdesigned. Each experiment requires separate analysis. Eventually the collection and analysis of additional engineering and economic data for a local environment are necessary in order to develop final and meaningful relations between pavement types.

All of the short span bridges are underdesigned. Each is a separate case study.

Failure and distress of the pavement test sections and the beams of the short span bridges is important to the success of each of the experiments.

The Highway Research Board of the National Academy of Sciences--National Research Council has the responsibility of administering the project for the sponsor, the American Association of State Highway Officials, within the bounds of the objectives of the test. The Board is also responsible for collecting engineering data, developing methods of analysis and presentation of data, drawing valid findings and conclusions, and preparing comprehensive reports describing the tests and the results. It is here that the role of the AASHO Road Test ends.

As the total engineering and economic process of providing highways for the nation is developed, engineering data from the AASHO Road Test and engineering and economic data from many other sources will flow to the sponsor and its member departments. It is here that studies will be made and final conclusions drawn that will be helpful to the executive and legislative branches of our several levels of government and to the highway administrator and engineer.

*Highway Research Board is a unit of the
National Academy of Sciences--National Research Council.

THE ASPHALT INSTITUTE

-has not sponsored, and is not sponsoring, any advertisements about results of the AASHO Road Test.

Further, The Asphalt Institute agrees with the propriety of the above request from AASHO officials. Also, The Asphalt Institute subscribes to the above statement of the INTENT of the AASHO Road Test.

J. E. Buchanan

J. E. Buchanan
President
The Asphalt Institute

Applications

(Continued from page 108)

LAURENCE HOUGHTON WILLIS, South Burlington, Vt.
CHARLES GEORGE YESLINE, Pittsburgh, Pa.

Applying for Affiliate

GREER ARMSTRONG ALLEN, Portland, Ore.
EDWARD SCHECHTER, Wilkes-Barre, Pa.

Applying for Associate Member

LAWRENCE HARVEY ANDERSON, Los Angeles, Calif.
THOR LIND ANDERSON, St. Louis, Mo.
ARMEN A. ANOOSHIAN, New York, N.Y.
PATAYA NA BANGEHANG, Urbana, Ill.
ROBERT LEE BARNETT, Centerville, Ohio
CHARLES ELMER BOWLER, JR., Takoma Park, Md.
JAMES FRANCIS BROADWATER, Jackson, Miss.
GUILLERMO CARO-MENDOZA, Bogota, Colombia
AMERICO CECI, Providence, R.I.
RICHARD CHAN, New York, N.Y.
FRANK MAURICE COLE, Cheyenne, Wyo.
JOHN SARGENT COUGAN, JR., Clinton, N.J.
DAVID ALAN CRANE, Sacramento, Calif.
GEORGE MEIR DACH, New York, N.Y.
PETER KUANG HSUN DAI, Urbana, Ill.
MITTAR PAUL DHIR, W. Lafayette, Ind.
JAMES ERIC ERICKSON, Dunsmuir, Calif.
FIORELLO ROSARIO ESTMAR, Bethlehem, Pa.
THOMAS ERWIN FERGUSON, JR., Dunsmuir, Calif.
HUGH CLOYES FLETCHER, Greenbelt, Md.
JOHN HOLLIS GARREN, Portland, Ore.
WALTER BRUCE GRANDEY, Knoxville, Tenn.
CAROL GRUNBERG, Montreal, Quebec, Canada
JOHAN THIEME HAARMAN, New York, N.Y.
DONALD HALLETT, Milwaukee, Wis.
VIRGIL EUGENE HOCHSTETLER, Chicago, Ill.
DONALD AXEL HOLMES, Glendale, Calif.
FRANCIS JOHN HOLMES, Bethlehem, Pa.
MOGILISETTY JAGANNADHARAO, Andhra Pradesh, India
NIMMAGADDA JAYARAM, Andhra Pradesh, India
BENDT JORGENSEN, Chattanooga, Tenn.
ABDUL LATIF KANOO, Bahrain, Arabia
MARCEL P. LAFRENIERE, Cambridge, Mass.
ANDRE HENRI LA LONDE, Trois Rivieres, Quebec, Canada
EDWIN THOMAS LATCHEM, Charleroi, Pa.
MORRIS LOSHINSKY, Brooklyn, N.Y.
DANA WILLIAMS LOVE, JR., New York, N.Y.
KURT MARTIN MAGAR, Cambridge, Mass.
DONALD WILLIAM MARSHALL, Houston, Texas
AWNI FUAD MASRI, Lafayette, Ind.
PHILIP JEFFREY MCQUEEN, San Francisco, Calif.
ZEIN MOHAMED OMAR, Khartoum, Sudan
JOHN ANAST PETROPOLE, New York, N.Y.
BERRY WARD PHELPS, JR., Grover City, Calif.
SAMUDRADEV PHUKAN, Fort Collins, Colo.
DONALD LORENZO POPPY, Durham, England
COURTNEY FRED PORTER, Lexington, Ky.
FRANCIS JOSEPH PRUE, Bangor, Me.
SUBBARATNAM RAMANATHAN, Urbana, Ill.
CLARENCE GEORGE REIDER, Milwaukee, Wis.
JAMES DAVID RIFFELL, Cleveland, Ohio
SUNIL KUMAR ROY, Urbana, Ill.
ROLAND JOSEPH SALVAS, Downsview, Ontario, Canada
THEODORE CHARLES SCHULTZE, Long Beach, Calif.
MELVIN MANUEL SCHWARTZ, Fresno, Calif.
THOMAS RICHARD SEAL, Kansas City, Mo.
INDRAVANDAN KESHAVLAL SHAH, Cambridge, Mass.
WILLIAM THORNTON SHEPPARD, Detroit, Mich.
NABIL ABDALLAH SHOEB, Cairo, Egypt
RICHARD MELVIN SLAYTER, San Diego, Calif.
WARREN DOUGLAS SMITH, JR., New Brunswick, N.J.
FRANZ GUSTAV KLAUS SONNENBERG, Evanston, Ill.
CHARLES JOSEPH TAGLIABUE, New York, N.Y.
JOSEPH ALEXIS TURCOTTE, New York, N.Y.
DANIEL EDWIN WARREN, Detroit, Mich.
GENE NEAL WASHBURN, Little Rock, Ark.
BERNARD NASH WEBB, Philadelphia, Pa.
JOHN ROBERT WEBSTER, Washington, D.C.
DAVID DING YOUNG, Toledo, Ohio

[Applications for the grade of Associate Membership from ASCE Student Chapter Members are not listed.]

Recent Books

(Continued from page 104)

of ASTM in San Francisco, October, 1959. Topics covered include methods of evaluation of potential wood preservatives and of chemicals poisonous to the marine borer, the analysis of creosote, studies on wood piles in sea water, and tests on preservatives and specific woods used in piling. (Published as ASTM Special Technical Publication No. 275 by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1960. 69 pp., bound. $2.50.)

Technical Writing

Written by an engineer with long and varied experience in technical writing, this handbook sets forth rules, formulas, techniques, and ideas in technical writing which will help the engineer select his material and organize and present it in a manner that will reach his readers at the level of their understanding. The author first defines "technical writing" and "writing level," and then gives examples of the five levels he sets up —from the nontechnical level, to the advanced engineering or scientific level of reader understanding. Then the selection of the appropriate words, and letter and mathematical symbols is discussed, followed by a description of the preparation of manuscripts. The book is completed by five glossaries of terms used in writing about such special topics. (By Joseph Racker. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1960. 234 pp., bound. $6.95.)

The Theory of Thin Elastic Shells

The 23 papers presented at this symposium (5 in German, 1 in French) discuss two aspects of shell theory—nonlinear theory and problems lacking axial symmetry. Frequently papers from two or more sources deal with the same topic, indicating simultaneous investigations in different countries, but these present different points of view and, collectively, a broad perspective of each problem. (Edited by W. T. Koiter. Interscience Publishers, 250 Fifth Avenue, New York 1, N. Y., 1960. 496 pp., bound. $9.00.)

Non-ASCE Meetings

American Institute of Architects. Annual convention in Philadelphia, April 23-28, 1961.

American Institute of Steel Construction. Thirteenth annual national engineering conference at the Hotel Leamington, Minneapolis, Minn., May 11 and 12, 1961.

American Society of Planning Officials. Twenty-seventh annual national planning conference will have its headquarters at the Denver Hilton Hotel, Denver, Colo., April 30-May 4, 1961.

American Society for Testing Materials. Sixty-fourth annual meeting at the Chalfonte-Haddon Hall, Atlantic City, N.J., June 25-30, 1961.

American Water Works Association. Eighty-first annual conference at Cobo Hall, Detroit, Mich., June 4-9, 1961.

Building Research Institute. Spring conference at the Shoreham Hotel, Washington, D.C., May 16-18, 1961.

Chi Epsilon Fraternity. Special meeting of the Alumni in Los Angeles, Calif., on May 6. The Honorable George D. Clyde, Governor of Utah, will be elevated to National Honor membership at the banquet in the Ambassador Hotel.

Conference on the Mechanics of Soil-Vehicle Systems. First international conference at the Turin Institute of Technology, Turin, Italy, June 1961.

Department of Health, Education, and Welfare. Two spring water-pollution training courses presented by the Sanitary Engineering Center, Cincinnati, Ohio. "Organic Industrial Wastes Characterization" is scheduled for May 8-19, 1961 followed by "Inorganic Industrial Wastes Characterization" on May 22-26, 1961.

Engineering Institute of Canada. Seventy-fifth annual meeting in Vancouver, British Columbia, May 31-June 2, 1961.

International Commission on Large Dams. Seventh Large Dams Congress in Rome, June 26-July 1, 1961.

International Society of Soil Mechanics and Foundation Engineering. Fifth international conference in Paris, France, July 17-22, 1961.

National Society of Professional Engineers. Twenty-seventh annual meeting at the Olympic Hotel, Seattle, Wash., July 4-7, 1961.

ENGINEERING SOCIETIES PERSONNEL SERVICES, INC.

(AGENCY)

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These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Chemical, Electrical, Mechanical and Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is run on a nonprofit basis.

If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular placement fee. Upon receipt of your application a copy of our placement fee agreement, which you agree to sign and return immediately, will be mailed to you by our office. In sending applications be sure to list the key and job number.

When making application for a position include eight cents in stamps for forwarding application.

Men Available

CIVIL ENGINEER, J.M. ASCE, B.S.C.E. Three years' engineering experience involving reinforced concrete and steel structural design. Also highway and airfield construction. Salary open. Prefer Foreign. C-667.

PROJECT ENGINEER, M. ASCE, B.C.E., M.C.E., 37. Ten years' experience in design and project work on major construction projects in both foreign and domestic fields. Desires position offering opportunity to advance with a growing organization. Available May 15th. C-668.

STRUCTURAL OR SALES ENGINEER, M. ASCE, B.C.E. and M.S., P.E. in New York and New Jersey. Five years in the design of steel and concrete highway bridges, one year in highway design, and two years in the design and construction of air fields. Salary, $9,000. Prefer Eastern and Middle Atlantic States. C669.

CIVIL ENGINEER, F. ASCE, B.C.E., Reg. P.E. in Michigan, Ohio, California. Fifteen years in water supply; reports, design, construction and administration. Thirteen years in structural design and stress analysis of aircraft and aircraft and missile ground support equipment. Prefer work in a consultants office. C-671.

CIVIL ENGINEER, HYDRAULICS, A.M. ASCE, B.S., M.S., P.E. Texas, 29 single. Three years in municipal development and highways and one and a half years with U.S.G.S. Water Resources Division. C-670.

TOWN ENGINEER OR SUPERINTENDENT OF PUBLIC WORKS, M. ASCE, B.C.E., Cooper Union. Experience with consulting engineers and contractors on highways, roads and industrial buildings. Includes surveys, alinement, sewers, water, pavements, traffic, lighting. Supervised engineers, draftsmen, surveyors, operators, laborers. Liaison with officials, towns, counties, state, contractors. Salary, $9,000. C-672.

CHIEF ENGINEER OR STRUCTURAL ENGINEER, M. ASCE, B.S.C.E., Reg. P.E., 32. Seven years design, estimating, selling and supervision with steel fabricator and industrial equipment manufacturer seeking engineering administrative position with medium sized firm. Presently chief engineer. Salary, $9,600. Prefer Midwest or South. C-2085-Chicago.

CONSTRUCTION OR FIELD ENGINEER, A.M. ASCE, B.S.C.E., 26. Two years in inspection supervision and administration of large overseas housing project; two years on location, design and construction of highways; some other design work and specification writing. Salary, $7,000 minimum. Prefer Foreign, West or Midwest. C-2108-Chicago.

CIVIL ENGINEER, A.M. ASCE, B.S.C.E., E.I.T., 25. Two and one half years with municipality designing, estimating, preparing specifications of sanitary and storm sewers. Three months as assistant resident engineer of sewage treatment plant construction. Salary, $7,000. Prefer Midwest. C-2109-Chicago.

CIVIL ENGINEER, A.M. ASCE, B.S. in C.E.; 18 hours of graduate school, 31. Highway design and construction; supervision of air base construction. Salary, $9,000. Prefer Overseas. C-2111-Chicago.

TIMBER RESEARCH AND DEVELOPMENT ENGINEER, A.M. ASCE, B.S.C.E., M.S.C.E., 27. Three years' experience as chief engineer of timber laminating and fabricating company and one year independent research on Epoxy Resins and flexible adhesives applied to timber structures. Salary, $7,800. Prefer U.S. C-2112-Chicago.

EXPORT SALES ENGINEER, A.M. ASCE, B.S.C.E. and Business Administration, 30. Six years' in export field with manufacturers of excavators, truck mixers, road paving equipment, batch plants, conveyors, bucket elevators, scotch marine boilers. Will relocate overseas or travel to marketing areas. Salary open. C-2113-Chicago.

PRODUCTION ENGINEER, A.M. ASCE, B.S.C.E., 27. Mine railroad experience and production experience in large surface iron ore mines for three years. Also safety engineer experience. Salary, $7,200. C-2114-Chicago.

HIGHWAY OR RAILROAD CONSTRUCTION ENGINEER AND/OR MANAGEMENT ENGINEER, F. ASCE, B.S.C.E., Univ. of Illinois, 57. Twenty-five years' experience abroad includes location, construction, cost keeping, maintenance, management. Speaks Spanish, Portuguese. Salary open. C-2115-Chicago.

MANAGER INDUSTRIAL DEVELOPMENT OR SALES AND PROMOTION FIELD, A.M. ASCE, B.S.C.E., P.E. 36. Three years with consulting firm, design and supervision of projects including airport, REA, water and sewage systems and municipal tax studies. Ten years' business experience in retail and wholesale sales field. Desire work in management or sales promotion fields. Prefer Midwest. Salary, $10,000. C-2116-Chicago.

CHIEF ENGINEER, PROJECT ENGINEER OR GENERAL MANAGER, F. ASCE, C.E. degree, registered in Ohio; 54. Thirty years' experience in administration and management, director of engineering and technical staffs, construction supervision, and field and office engineering. Extensive experience in maintenance-management. Salary, $10,000 minimum. Prefer, South or Southwest. Will consider foreign and domestic assignments in other locations. C-2117-Chicago.

CIVIL ENGINEER, A.M. ASCE; B.S.C.E., Fenn College, 29. Four and a half years' experience; three years in a consulting office drafting, design, checking and estimating; and one and a half years with construction company drafting, design, estimating and job supervision. C-2118-Chicago.

MUNICIPAL OR RESIDENT ENGINEER, M. ASCE, B.S.C.E., M.S.C.E., reg. P.E. and Land Surveyor, 32. Experience in structural and mechanical design of sewage treatment plant facilities; layout, administration, and construction supervision; municipal engineering design including roads, sewers, plot work, surveying and investigations. Salary, $9,000. Prefer Midwest or South. C-2119-Chicago.

Positions Available

STRUCTURAL ENGINEER, M.S. or Ph.D. to conduct design and experimental studies of a variety of structures. Challenging and varied problems involving the application of high strength and constructional alloy steels. Experience not required but applicant should have a thorough understanding of structural behavior. Large research laboratory. Submit resume and salary requirements. Western Pa. W-119.

ENGINEER, capable of taking complete charge of precast concrete operations, sales, estimating, production, plant manager. Must have had precast experience. Be able to meet and supervise people. Salary open, New York City. W-98.

STRUCTURAL ENGINEERS, with a minimum of five years' experience for the design of reinforced concrete and structural steel for water plants, pump stations and general building construction. Will be responsible for design with a minimum of supervision. Salary, $8,500-$9,000. Philadelphia, Pa. W-86(*a*).

MANAGER OF CONSTRUCTION to take charge of overall construction projects of a chemical plant nature. Must assume executive and administrative responsibility and be well grounded technically. Salary, $15,000-$25,000. New York City. W-84.

ESTIMATOR for detailed estimating of engineering construction projects including water works sewage treatment plants, pumping stations, factories, etc. Check shop drawings, prepare piping drawings for submittal to consulting engineer. Field layout of projects, pipe lines, check sleeve locations. Graduate civil, with Master's degree in sanitary engineering desired. $6,500-$7,000 a year. Ohio. W-77.

SOILS ENGINEER, graduate civil, with field experience in foundation investigation, testing and laboratory management. Will supervise field exploration and soils lab testing for highway construction. Will be required to analyze field information and test data to develop design criteria and recommend construction technique. Salary open. Intermountain West. W-65.

This is only a sampling of the jobs available through the ESPS. A weekly bulletin of engineering positions open is available at a subscription rate of $4.50 per quarter or $14 per annum, payable in advance.

SUPERINTENDENT OF WATER DEPARTMENT for an industrial city of approximately 17,000. Degree in sanitary or civil engineering, with about two years' experience. Salary, $6,000-$7,000. Northwestern Pa. W-64.

CHIEF FIELD ENGINEER, civil, for small contracting firm doing alterations, bridge repairs, viaducts, demolition, etc. Will be in charge of several jobs. Salary, $9,000. Long Island. N. Y. W-59.

SUPERINTENDENTS. (*a*) Construction superintendent, preferably graduate, with eight to ten years' experience mostly on public works, for a general contractor. Salary, $7,500-$12,000. (*b*) General superintendent, engineering background, for full field force. Will be responsible for all construction operations for medium sized construction company, specializing in general roads, paving, drainage. Salary, $10,000-$15,000. Long Island. N.Y. W-54.

PROJECT TECHNOLOGIST, graduate mechanical or civil, with advanced studies and experience in processing plants fields. Broad problems in technology ranging from stress, metallurgy, structures, analysis of designs and equipment, etc. Salary, $10,200. New York City. W-50(*c*).

DESIGNERS AND DRAFTSMEN. (*a*) Architectural lead designers or draftsmen, experienced in commercial and industrial buildings; knowledge of building codes. (*b*) Designer, HVAC and plumbing. (*d*) Designer and draftsman, structural. Salaries open. Tennessee. W-41.

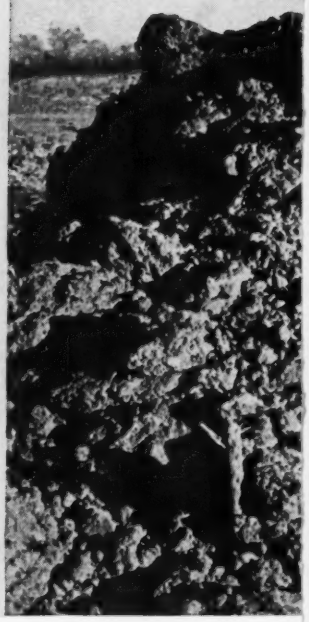
SOILS ENGINEER, C.E. degree, 38, with basic and at least two graduate level courses in soils. Total of at least 10 years' practical engineering experience including at least two years each on construction and in design and at least two years in responsible position in soils engineering. Location, central New York. C-8561.

STRUCTURAL DESIGNER, graduate C.E., with three years' experience in steel and concrete design on heavy industrial buildings, grain elevators, docks, etc., for a consultant. No bridge or sanitary work. Salary, to $10,000. Employer will pay placement fee. Canada. C-8552.

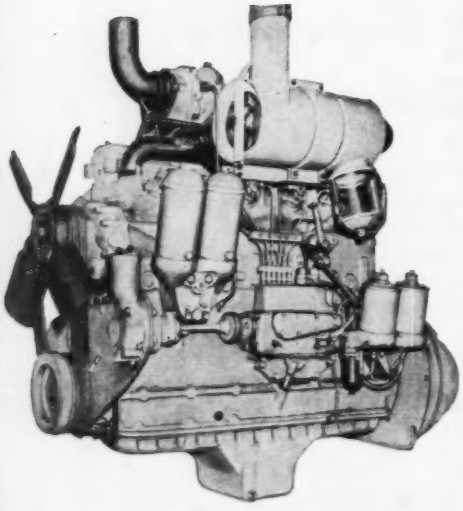
OWNERS REPRESENTATIVE, B.S. degree, considerable experience in the layout of shopping centers. To act as owners representative, work with construction people in field to determine layout and building of shopping center work—no other type of building work will be considered. Salary, $15,000-$18,000. Employer will pay placement fee. Chicago. C-8544.

NEW International® TD-

...built to "BEEF UP" your profit edge!



From air intake to new fixed drawbar —from day-to-day dependability through year-in, year-out durability—new strength, new performance protection, new work capacity are built into the new TD-20. Check and compare the advantages of International turbocharged Diesel power, teamed with beefed-to-match new transmission and final drive components—platformed on a far stronger-than-ever undercarriage—turned into new efficiency by International-built tracks, kept in life-prolonging alignment by exclusive International 3-point suspension. See your International Construction Equipment Distributor for a new TD-20 demonstration.

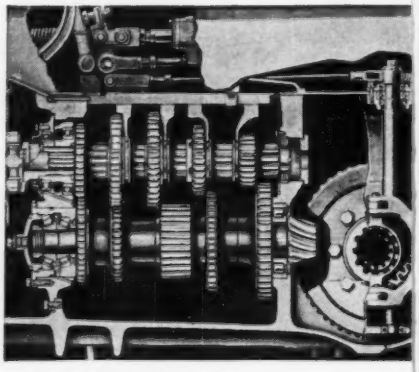


New Turbocharged Diesel Wallop

Modern turbocharging crams air into the new TD-20's smooth running 6-cylinder engine—to produce extra hp efficiently at all altitudes; and to give a 50% torque rise to lug larger overloads. Crankcase ribs are "beefed up;" cooling, air cleaning, and crankshaft capacity all are increased to team with turbocharging. Push-button TD-20 starting is by famous International gasoline-conversion system!

Larger radiator plus jet head increases cooling capacity

Coolant, under pressure from the new greater capacity radiator, is shot through jets against lower surface of TD-20 heads—to aid heat transfer and avoid build-up of heat-trapping deposits. Fan shroud and radiator guard are "heavied" for increased rigidity.



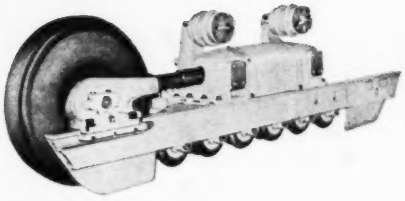
New transmission capacity ...New filtering system added

Heavier shafts, more rugged gears, and roller bearings of greater capacity are provided—to carry increased hp and add thousands of hours to working life of power train components. New transmission oil pump circulates and filters life-guarding lubricant. New "short-travel" levers add operating ease.

-20

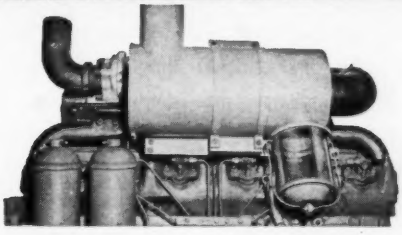
(201 SERIES)

New 140-hp International TD-20 crawler tractor. Develops 113 drawbar hp. Powered by 6-cylinder DT-691 Turbocharged Diesel engine. New capacity 6-speed, full-reverse transmission is controlled by new short-travel gear-shift and Shuttle-Bar levers.



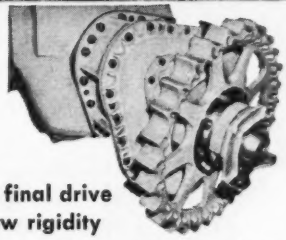
New Undercarriage Strength and Protection

New drum-type front idlers add strength... International also adds track chain guides to both sides of the TD-20's precision-welded double box-beam track frames! New track roller shields are of cast steel. New heavier strutless track links are self-cleaning and power-saving. The new hydraulic track adjuster, with built-in safety relief is "standard" on the new TD-20. And full-floating seals of increased efficiency guard Dura-Roller life!



New 99.8% efficient Dry-Type air cleaner

For positive "breathing" safety, the full air volume taken in by turbocharging is "dry-cleaned" of 99.8% of its dirt—by the TD-20 Diesel's new dry-type air cleaner. Handy, under-hood horizontal mounting—and transparent, quick-dump collector—greatly simplify servicing. Dash indicator shows "red" when cleaner element needs washing.



New final drive ...new rigidity

New TD-20 final drives have been strengthened to deliver full torque turbocharged power to the tracks. New sprocket drive doweling increases housing rigidity—helps maintain precision component alignment. Other major steps ahead in TD-20 design include: new torque-taking, life-adding bimetallic steering clutch discs; new pivot shaft inner spacer; new hardness of sprocket drive pinion shaft.

International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE

CATALOG DIGESTS of ENGINEERING and INDUSTRIAL interest

1 ACCESSORY PRODUCTS

Ozalid Division of General Aniline & Film Corp.—A new 40-page catalog, containing descriptions and illustrations of over 100 products for engineering, architectural, accounting and general office reproduction use, is available. The catalog and price list contain the latest information on the expanded product line and is designed to serve as a reference book on copying needs.

Please give your complete address.

2 AERATION IN SEWAGE & WASTE TREATMENT

Walker Process Equipment, Inc.—Jack Knife, double pivot air header assemblies and Sparjer diffusers are described and illustrated in bulletin 22-S-96. Jack Knife assemblies permit inspection of the diffusers without interrupting the aeration process and feature an air control valve built into the top pivot joint. Sparjers feature orifices made of TFE Fluorocarbon resin to provide the most clog resistant material available.

Mail This COUPON To-day

CIVIL ENGINEERING Date.....

33 West 39th St., New York 18, N. Y.

Please have the literature indicated by the circled CATALOG DIGEST numbers in the April 1961 issue sent to me without obligation.

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*** There are charges for items Nos. 22, 37, 94 and 229. See Notes below these items.**

To receive Literature—Firm Name and your Position must be given

Name .....
(Please Print)

Position ..... ☐ Am. Soc. C.E. Member ☐ Non-Member

Firm Name .....

Firm Address—Street .....

City, Zone and State .....

NOT GOOD AFTER MAY 15, 1961, for readers in the U. S., but requests will be accepted to June 30, 1961, from readers outside of this country.

3 AIR STREAM MOTORS

Fairbanks-Morse Electronic Div.—Bulletin 203 describes and illustrates these motors which were designed for increased service factor and horsepower output. Specifications are also included for required minimum air velocity-enclosed air-stream motors.

4 ALL WEATHER RUNNING TRACKS

American Bitumuls & Asphalt Company—A booklet on an approach to construction of oval tracks for track meets has been announced. This Grasstex Track (proved at the University of Florida) offers low initial cost; very low maintenance; year-round utility; and fine performance experience.

5 ALUMINUM GRATING

Borden Metal Products Co.—A brochure by way of diagrams and photos illustrates the properties and use of aluminum floor gratings. Also shown are tables of their specifications. A description of safety grating and aluminum safety steps is featured.

6 ALUMINUM GRATING AND TREADS

Irving Subway Grating Co., Inc.—This Aluminum Grating catalog contains illustrations, descriptions, loads and spans table, weights, and other engineering data on aluminum riveted, pressure-locked grating products, for use as flooring, treads, walkways and trench covers. They are light weight, non-rusting, self-draining, self-cleaning, ventilating, fireproof and economical.

7 ALUMINUM GRATING DESIGN

Kerrigan Iron Works Co.—A catalog on Weldforged aluminum grating is offered. New forming process prevents cross bars from turning —eliminates the use of rivets, bolts and screws. It contains engineering data including safe load table and also stair tread data.

8 ALUMINUM LIGHTING

Kerrigan Iron Works Co.—Full data catalog on new line of seamless, round tapered aluminum lighting standards for street, highway and area lighting. Wide variety of styles, includes traffic signal standards, brackets and mast arms.

9 ANTI-CORROSIVE PAINT PIGMENT

Eagle-Picher Company—Makes highly effective anti-corrosive paint pigment, Basic Lead Silico Chromate, known as Permox 1-4-3. Meets approval of Federal and State Civil Engineers for both primer paints and complete painting systems. Illustrated Permox 1-4-3 book gives recommended formulations for primer, intermediate and finish coats; contains accurate color chips of available tints. Booklet free on request.

10 ASPHALT LINER MANUAL

W. R. Meadows, Inc.—announces the availability of a "Hydromat" Asphalt Liner Manual. The "Hydromat" Manual fully describes applications and contains installation information, necessary technical engineering data and specification information. This is not a sales catalog, but strictly a Technical Data Manual.

11 ASPHALT PAVING

The Asphalt Institute—Manual Series No. 8 is designed as a guide and reference book for highway engineers and contractor personnel. Proper procedures for placing and compacting asphalt paving mixtures are explicitly set forth.

12 ASPHALT SPREADER

Essick Manufacturing Company—A bulletin issued describing the functions and specifications of the Model 710 Asphalt Spreader. Some of the features include a large fluid tank with perforated distribution pipe for wetting roll, adjustable telescoping extension blade sections 3 feet long, double lock screws that hold blade end sections firmly at width selected and an 8 foot long sturdy steel leveling skid.

Use This Free Service—Mail The Coupon To-day

13 ASTM SPECIFICATIONS

Bethlehem Steel Company—A 68-page booklet, no. 569, contains the complete specifications for ASTM A7, ASTM A373, ASTM A36, ASTM A 440, ASTM A 441 and ASTM A 242, reprinted with the permission of ASTM. These grades meet 98 per cent of all the usual structural steel requirements.

14 ATOMIC ENERGY

Allis-Chalmers Mfg. Co.—Accomplishments in design and construction of reactors here and abroad are presented in this bulletin. Also included is information on the many resources and services which the company's Atomic Energy Division can provide along with a discussion of the division's technical personnel, research and production facilities devoted to atomic energy problems.

15 AUGER TOOLS

Acker Drill Co., Inc.—Auger Tools, described in Bulletin 13, is entirely devoted to new tools and techniques in Auger boring and sampling. The latest information on hollow-stem augers is clearly presented.

16 AUTOCOLLIMATING THEODOLITE

Kern Instruments, Inc.—Information is available on the Autocollimation Eyepiece, which when attached to the DKM2 1-sec Theodolite, becomes an integral part of the instrument. Total telescope magnification is 23x, working distance up to 100 ft indoors. The light source is an easily replaceable standard 3-V or 6-V bulb. The instrument can be used for normal surveying without removing the eyepiece by simply switching off the light which illuminated the reticule.

17 AUTOMATIC LEVEL

Keuffel & Esser Co.—"From Field Practice for Field Practice with the Automatic Leveling Zeiss Level Ni2," a 64-page booklet, offers case histories and operation details on the Ni2 level, an instrument with a built-in compensator. The booklet is divided into three sections. The first gives case histories showing how the Ni2 functions well in all temperatures and weather conditions. The second gives hints for practical uses of the Ni2. The third lists publications concerning leveling with the Ni2.

There are 260 Digest items on pages numbered 118 to 143. Read all items for the literature of interest to you.

18 AXIAL AND MIXED FLOW PUMPS

C. H. Wheeler Mfg. Co., Economy Pump Div.—A 12-page catalog describes Axial and Mixed Flow Vertical and Horizontal Pumps for applications in flood control, irrigation and drainage projects, large scale primary water supply, industrial and process work, and power plant condenser circulating systems. Catalog includes construction and design details, station arrangement suggestions, and illustrations of typical installations.

19 BATCHETRON 900

Fairbanks-Morse Electronics Div.—This bulletin describes how this new batching control system automatically selects and weighs out materials, indicates operating sequence, and thinks at the speed of light. Illustrations show the mixing and process for the asphalt and concrete proportioning.

20 BITUMINOUS FINISHER

The T. L. Smith Company—The brochure offered illustrates the Mark IV. It features swept back screen, a swinging operator's platform with visibility to the right and left, extra flotation with large pneumatic tires and folding side wings on the hopper to permit trucks of all sizes to unload mix spillage yet move the entire load to the conveyor without hand shoveling or prodding.

21 BITUMINOUS PAVER

Blaw-Knox Company—A new Paver of large capacity and high speed is described in Product Fact Sheet AP-100. Other features in this machine include dual control, automatic two-speed auger and conveyor control, and hydraulically-driven tampers. A new concept in flotation is one of the most important features of this paver.

CATALOG DIGESTS

22 BOOK OF WEIGHTS

C. W. Haasis—The weights of minerals, metal and metal products (as pipe, sheets, rods, wire, fencing) are given in this book. Also given are the weights of construction materials (as cement, sand, stone, lumber, brick, etc.) building elements (as walls, roofs, floors, etc.) and commodities (farm produce and articles of commerce). In addition the book gives foreign units of weight, weight conversion tables and weight per foot of hold space in steamers. The price is $1.25 per copy plus .15 postage.

N.B. There is a charge for this book. Please make checks payable to C. W. Haasis.

23 BORINGS

Raymond International Inc.—A booklet "Subsoil Investigations for Foundations" Catalog B-7 explains the reason for subsoil investigations, what Raymond borings are and how they are made, and the results obtained. Illustrated are methods for making borings and taking samples, and various types of rigs in operation.

24 BRIDGE DECKING

Irving Subway Grating Co., Inc.—The 12-page catalog on Irvico Decking for bridges contains illustrations, descriptions and engineering data on metal grid bridge flooring, including the special beam type decking and the new C-K surface. It points out the features which include light weight, cleanliness, drainage, safety, durability, traction, strength and economy.

25 BRIDGE FLOORING

United Steel Fabricators—An 8-page brochure is now offered on the installation, design and specifications of bridge flooring. Step by step detail is also illustrated starting with the removal of old planks from the bridge to the completed galvanized, wear-resistant, surface.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

26 BUILDER'S TRANSIT-LEVEL

The Eugene Dietzen Company—now offers a one page circular that describes and illustrates the "2 in 1" level. This combination instrument incorporates a side mounted focusing knob for easier focusing, top-mounted "rough" aiming sight and totally enclosed leveling screws that are removable and replaceable.

27 BUTTERFLY VALVES

Allis-Chalmers-Hyd. Division—In this 46-page booklet is the description, specifications and illustrations for uses of this valve. It features minimum pressure drop which saves power, tight closure reducing leakage, uniform control in all positions, the regulation and closure are quick and it is compact and lightweight.

28 CABLE HIGHWAY GUARDS

American Steel & Wire—A 20-page complete catalog on the subject of Multisafty Cable Highway Guards, including blueprints of various constructions commonly utilized on highways and the information on all components, is now available.

29 CAM-LOCK SYSTEM

Gates & Sons, Inc.—This system is highly versatile, rigid and adaptable to low or extremely high walls using inexpensive re-useable material. Illustrations and directions in this brochure show wall and panel construction. The use of many brackets such as: cone tie, cone grout anchor, breakback tie and scaffold bracket are also shown.

30 CARPULLERS

Superior-Lidgewood-Mundy Corp.—A 24-page 2-color bulletin C-616 "Carpullers for Easy Moving Rolling Loads" is available, with descriptions, illustrations, data, tables, and specifications for Carpuller requirements. Illustrates and describes the Electric Capstan Carpuller for car moving, barge moving, pipe bending or any haulage of similar nature; also Tugmore Capstans, Horizontal Head type Capstan Carpullers, Drum Type Carpullers, Friction Drum Type Carpullers, etc.

31 CAST IRON PIPE, HYDRANTS AND VALVES

R. D. Wood Company—A general catalog is available providing full details of weights and dimensions of "sand spun" cast iron pipe and cast iron fittings. This catalog also features fire hydrants, gate valves, and other products manufactured by this company.

32 CATIONIC BITUMULS

American Bitumuls & Asphalt Company—After extensive testing, the company is offering an entire line of Cationic Emulsified Asphalts. The booklet covers every phase of application, from surface treatments to mixing operations. Of all developments in the paving field, this appears to have most promise because it permits re-activation of old, by-passed aggregate sources and less concern for early rain.

33 CEMENT LININGS

Centriline Corporation—The Centriline Process for cement mortar lining steel, cast iron, concrete and terra cotta pipelines in place and which has been available in the diameters 16 in. to 144 in. can now be used in pipelines as small as 4 in. in diameter. This new adaptation of the Centriline Process for small pipelines eliminates the necessity for excavations at laterals and corporation cocks and is fully described in the new illustrated catalog.

34 CIRCULAR PRESTRESSED TANKS

The Preload Company, Inc.—Bulletin T-15 is being offered, covering the use of circular prestressed concrete tanks in the chemical, pulp and paper, cement and water supply fields.

35 CLAY PIPE

National Clay Pipe Manufacturers, Inc.—A 6-page brochure, "Lifetime Vitrified Clay Pipe," is of particular interest to professional engineers. It contains lists of ASTM, ASA and AASHO specifications applicable to vitrified clay pipe, and describes new factory-made pipe joints. Clay processing today, and the typical characteristics of vitrified clay pipe also are included.

PLEASE BE PATIENT

YOUR REQUESTS TAKE TIME

36 CLAY PIPE

National Clay Pipe Manufacturers, Inc.—This 48-page fully illustrated brochure entitled "The Story of Clay Pipe" contains an historical record of clay pipe, its contribution to America from the beginning of the 20th century to the present, and a look into the future of American homes, industries and communities.

37 COFFERDAMS

Spencer, White & Prentis, Inc.—"Cofferdams," by Lazarus White and Edmund Astley Prentis is a trusted source-book covering actual design and construction of cofferdams as well as the theoretical features. The price is $10.

N.B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

38 COMMERCIAL FORMING APPLICATIONS

Gates & Sons, Inc.—offers this brochure discussing horizontal and vertical rod high wall forming, tie spacing, form types, radius wall forming, stripping, layouts and special applications. The procedure used results in smooth, even walls plus a saving in time, labor and materials.

39 COMMERCIAL POOLS

National Pool Equipment Co.—This 16-page commercial pool brochure in full color features many of the outstanding public pool installations throughout the U.S. This pictorial publication highlights motel, community, club, military and university pools with general layout and sizes.

40 COMPACTION METHODS BOOKLET

The Galion Iron Works & Mfg. Co.—Booklet No. SR-31, an informative, well-illustrated, non-technical, 16-page pamphlet covering all types of rollers and other compaction equipment has been published. This treatise will be especially helpful to anyone who has previously had no opportunity to study the subject of soils and materials compaction, the problems encountered, and the application of the various types of equipment available.

41 COMPOSITE CONSTRUCTION

Nelson Stud Welding Div. of Gregory Industries, Inc.—A comprehensive bulletin explains what composite (concrete and steel) construction is, how it works, its various advantages and economies and how it has been used in all types of building construction.

42 COMPUTER

Control Data Corporation—Offered in their booklet is the description of the Model 1604 all-transistorized digital computer system. It has large storage capacity, unusual computation and transfer speeds and special provisions for input-output communication. It is suited for large volume data processing and for solving large-scale scientific problems.

43 CONCRETE ADHESIVES

Thiokol Chemical Corp.—This new 8-page bulletin describes important applications for polysulfide-base concrete adhesives in concrete construction and repair. It illustrates the basic techniques using adhesives for resurfacing and patching pavement either with portland cement concrete or by means of quick-setting "adhesive/aggregate" mortars. Also noted are methods for skidproofing pavement and surface sealing pavement and structures.

44 CONCRETE ADMIXTURES

Master Builders Company—A guide for specification writers and contractors on concrete admixtures, iron-armoured floor products, grouting and waterproofing materials and other related products for improving concrete and mortar is now available. It contains 10 pages of specifications for concrete, concrete floors, colored concrete floors, equipment grouting and masonry mortar, based on current ASTM and ACI standards.

45 CONCRETE CONSTRUCTION

Richmond Screw Anchor Co., Inc.—A handbook, consisting of 12 bulletins of between 4 and 24 pages each, enclosed in a loose-leaf bind cover is offered. This handbook has a cross index for products and types of construction and contains forming details and technical data.

46 CONCRETE FORMING SYSTEM

Economy Forms Corporation—A catalog with pictures is offered showing a complete forming system available to contractors on a purchase basis. The easy adaptability of these forms to all types of form work, plus engineering layout service on each new project, together with a complete steel form good for a lifetime of service makes the EFCO form an attractive investment for the large and small builder. Also available, a four-page leaflet covering forms for prestressed or precast concrete beams, etc.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

47 CONCRETE FOR STADIUMS AND AUDITORIUMS

The Master Builders Co.—Concreting problems encountered and solved in the construction of 16 stadium and auditorium projects in this country and abroad, are explained in this 20-page Master Builders Co. publication. The role played by "Pozzolith" in acquiring the desired handling properties of concrete during placement and to meet exacting requirements for hardened concrete is also stressed.

48 CONCRETE PIPE

No-Joint Concrete Pipe Company—This company offers a pamphlet describing the tamped and vibrated, arch design, cast-in-place, concrete pipe laying process. Another advantage is that cast-in-place pipe forms a near perfect bond, with the bottom 230° and side walls of the trench giving added strength.

49 CONCRETE TESTING MACHINES

Forney's Inc., Tester Div.—A revised catalog is offered describing a complete line of concrete testing machines for plant, jobsite and laboratory testing of cylinders, cubes, beams, blocks, tile and pipe. Capacities range from 60,000 to 500,000 lb. Also described is a complete line of collateral concrete testing apparatus including L.A. Abrasion Machines, Cube and Beam Molds, Cylinder Molds and Capping Apparatus, Slump Cones, Kelly Balls and Air Meters.

50 CONCRETE WATERSTOPS

Water Seals, Inc.—Labyrinth® Waterstops are manufactured of polyvinyl plastic, which helps maintain a constant, strong, watertight bond between concrete joints. A catalog describes the convenient features of Labyrinth® Waterstops, including those which render it resistant to age, chemical and weathering changes. Blueprint type specification drawings include the Labyrinth, Flextrip, Cellular and Dumbbell waterstops in their various sizes. A table lists the recommended joint application and water head for each size and kind of waterstop.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

51 CONSTRUCTION EQUIPMENT

The R. C. Mahon Company—offers five catalogs entitled: Steel Deck, M-Floors, M-Decks, Curtain Walls and Rolling Steel Doors. For those in the architectural, engineering or construction fields, the section on property and load tables contained in the three Deck and Floor Catalogs, and the new load tables in the Curtain Wall Catalog will be of interest. The Rolling Steel Door Catalog shows details of the "jumbo" slat. The books are available individually or bound together as a general catalog.

52 CONSTRUCTION SPECIALTIES

Universal Form Clamp Company—Forms, form ties, accessories, construction specialties and highway products are well illustrated and described in this new 56 page catalog.

53 CONTINUOUS LOADER

The Eimco Corporation—How the 635 Continuous Loader can achieve production loading rates of up to 8 tons per minute of rock and ore are detailed in Bulletin L-10688. This low headroom loader has an extremely fast bucket cycle. The bulletin contains complete specifications and operating features.

54 COPYFLEX

Charles Bruning Company, Inc.—A new 16-page illustrated booklet describing basic uses for the Copyflex system in streamlining paperwork operations in business and industry is now available. This machine eliminates slower, costlier, out-dated methods and can substantially reduce common paperwork barriers.

55 CORE DRILL

Acker Drill Co., Inc.—will send to interested readers free of charge a completely illustrated booklet describing their new Contractor's Core Drill. This drill uses thin wall diamond bits and will core concrete, tile, reinforced masonry, and etc. Extremely useful for construction work, test laboratories and etc. Ask for Bulletin 27.

56 CORRUGATED METAL PIPE AND PIPE-ARCH

Armco Drainage & Metal Products, Inc.—Described in this catalog, CM8-5859, are the various types of factory-fabricated, riveted or locked-seam corrugated metal pipe and pipe-arches. It describes these types, explains their advantages, assists in making dimensional and material decisions, and recommends general installation procedure. Tables, drawings, and photos of representative installations are included.

There are 260 Digest items on pages numbered 118 to 143. Read all items for the literature of interest to you.

57 CURVE CROWN PULLEY

Stephens-Adamson Mfg. Co.—The availability of Bulletin 558 on the new Curve Crown welded, all steel Pulley has been announced. The literature features comprehensive technical and engineering data, specifications, diagrams and illustrations.

58 D/M GAUGE

Nuclear-Chicago Corp.—The surface and depth measurement of moisture content and density of soils concrete, asphalt and other construction materials used in the highway, airfield, dam, and building construction industries is described in the new brochure. The gauge is a modern, portable system of instruments using the Nuclear, non-destructive, method of determining moisture and density in as little as two minutes per measurement.

59 DEMERSIBLE PUMPS

The Deming Company—The Sump Pump and the Sewage Pump are described in two bulletins now offered. They are more commonly known as demersible pumps and are used where space is at a premium, as for example, they could be submerged in a pit below an undercut, out of sight and out of harm where they would be undisturbed.

60 DESIGN MANUAL

W. R. Meadows, Inc.—has prepared a manual entitled "Design Techniques for Controlling Moisture in Building Structures." This manual, prepared by a firm of technical engineering writers, was originally planned to sell for $1.00 per copy. However, as this problem is of vital interest to all in the construction industry, this company will now send a free copy to all architects, engineers and builders who desire a copy for their file.

61 DENSION CORE BARREL

Acker Drill Co., Inc.—offers free of charge, a copy of Bulletin 1100, which describes the Dension Core Barrel. Acker has obtained exclusive manufacturing rights to the tool. The brochure illustrates and describes how the core barrel operates. The cutaway drawing of the barrel shows all of the important operational features.

62 DEWATERING PUMPS

The Gorman-Rupp Company—This illustrated and descriptive brochure gives the specifications for pump and motor standards operations underwater. This submersible pump uses less power, is easy to install and easy to operate. It requires only the connection of the power to the control box.

63 DIAMOND BIT AND CORE BARREL

Acker Drill Company, Inc.—Bulletin 10 describes and illustrates the company's complete line of diamond bits and core barrels. The core barrel illustrations are shown as cutaways to facilitate the reader's interpretation of construction and drilling.

64 DIGESTER CIRCULATING-MIXING EQUIPMENT

Walker Process Equipment Inc.—The Gaslifter is an exclusive development for circulating and mixing digester contents. Grease and scum blankets and bottom deposits are eliminated resulting in increased digester efficiency and capacity. The Gaslifter utilizes digester gas, through the air lift principle to effect the circulation action. Bulletin 25-S-91 furnishes details and photos of installations.

RETURN THE COUPON
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RESULTS!

65 DIGESTER SLUDGE HEATING EQUIPMENT

Walker Process Equipment Inc.—The Heatx for digester sludge heating is presented in Bulletin 24-S-82. Designed specifically for sludge heating the Heatx features a custom burner and heat exchanger combined with a separate boiler to furnish the most efficient system available. The units operate on digester gas with automatic switchover to either natural gas or oil for auxilliary fuel. Capacities range from 110,000 to one million btu/hr.

66 DOUBLE-SEALING FASTITE JOINTS

American Cast Iron Pipe Company—This revised illustrated 12-page brochure describes the advantages of the double-sealing, single gasket Fastite Joint. It contains instructions for assembly, weights and dimensions, and typical installations of American Fastite pipe for water, sewage and other liquid service.

67 DRAFTING MATERIALS

Koh-I-Noor, Inc.—has a catalog for 1961 and 1962 offering a complete line of materials and equipment for the engineer, designer and draftsman. It also offers a line of stationery and artists supplies. The complete line is coordinated to provide high levels of professional performance to the discriminating professional.

68 DRAIN GATES

Irving Subway Grating Co., Inc.—A four-page, two-color folder illustrating the use of open mesh steel flooring as drain grates is available. The folder contains photographic illustrations and shows typical uses of drain grates. There are engineering drawings of the various types and complete technical data to facilitate estimates and specifications.

69 DYNAHOE

Hy-Dynamic Company—An important feature of the Dynahoe described in this bulletin is that it is a complete loader, tractor and backhoe in one integrated unit. Easy to handle, it has unusual visibility for both backhoe and loader operations. More information is available upon request.

70 ELECTRIC GENERATOR SETS

Fairbanks, Morse & Co.—Stationary, portable and mobile electric generator sets are presented in this 12-page booklet. Included are general applications, and specifications of the different models shown.

71 ELECTRIC SUBMERSIBLE PUMPS

Flygt Corporation—has a folder containing leaflets illustrating and describing most of their "dirty water" pumps. The pumps are used for trash, sewage and general disposal. Also offered is the new compact pump, the Bibo 3", weighing only 88 lbs. with delivery up to 20,000 GPH.

72 ELEVATED TANKS

Pittsburgh-Des Moines Steel Co.—Details of the several different types of elevated steel tanks, including capacity, ranges, tank dimensions, and other factors to be considered in the selection of storage tanks. Also available, 4 pages of pictures and discussion about flat bottom water storage.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME

73 ELLIPTICAL CONCRETE PIPE—LO-HED

American-Marietta Co.—This pamphlet covers elliptical Lo-Hed Reinforced Concrete Pipe for culverts and sewers. Specifications are given for the complete range of sizes from the equivalents of round pipe 18-in. I. D. through 144-in. I. D. Illustrations show results of pressure tests and installations of Lo-Hed pipe being made on various types of jobs.

74 ENGINEERING DATA

Lefax Publishers—A catalog describing Engineering Data Books with highly condensed authoritative data, for engineers, technical men, teachers and students is being offered. The catalog is free, but there is a charge for each data book.

75 ENGINEER'S LEVEL

Kern Instruments, Inc.—Information is available on the Kern GK 23, a compact, economical, faster instrument for precise leveling. Shorter set-up time and greater stability result from a ball-and-socket base. Enclosed level vial is protected against the elements. Coincidence bubble is visible through main telescope. It also has a rotatable horizontal circle and detachable plug-on optical micrometer.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

76 FENDER BUFFER

General Tire & Rubber Company—Raykin Fender Buffer Brochure gives complete description and full technical data for design work on Port fendering installations. Ratings for all units, terminal reactions, energy absorption, angular loading capacities are included.

77 FIBRE FORMS

Sonoco Products Co.—Uses of Sonotube, fibre forms, are illustrated in a brochure. These fibre forms provide an economical method of forming round, obround, half-round and quarter-round columns. Also encasement of steel and wooden piles, existing columns and utility risers. Available in several different types, the newest of which provides a form surface requiring little or no rubbing of the finished column. Technical data also available.

78 FIBRE TUBES

Sonoco Products Co.—Sonovoid, fibre tubes, were specifically developed to form voids in bridge decks; wall, floor, roof and lift slabs and in concrete piles. Uses illustrated in a brochure. Sonovoid, fibre tubes, are used in precast or cast-in-place units of conventional or pretensioned construction. Tie down and spacer method shown along with design data for 8-in. and 12-in. slabs. Other technical data available.

79 FILTER MEDIUM

Anthracite Equipment Corp.—The free catalog, "Anthrafilt Hard Coal Filter Medium" gives complete technical data on the sizes and uses of "Anthrafilt" as a filter medium for municipal and industrial filters. It outlines the advantages of "Anthrafilt" over sand as a filter medium.

80 FIRE PUMPS

Layne & Bowler, Inc.—Illustrated in this 6-page bulletin are the cross section drawings, typical installations, size and capacity charts and detailed advantages of a vertical fire pump. Both oil and water lubricated types are shown, complete with accessories to meet necessary requirements.

81 FLASH VEST

Warren-Knight Company—The safety flash vest is made of a vinyl coated heavy cotton in a fluorescent orange red with contrasting luminescent white stripes. Designed to fit over any type of clothing, it is perforated for coolness and comfort. More information is available on request.

82 FLOORS

Norton Company—The non-slip floors providing extra safety even when wet are described in this 7-page booklet. The floors are available in 4 distinct forms; alundum terrazzo aggregate, alundum cement floor aggregate, alundum and crystolon non-slip abrasive and alundum stair and floor tile all providing unusual wear resistance and permanent safety.

83 FOUNDATION PILES

C. L. Guild Construction Company, Inc.—COBI cast-in-place piles are featured in this booklet offered. The benefits of these piles include: their maximum soil sustaining power; their maximum resistance to settlement; their firmness when set at the required depth plus the highest possible uplift capacity.

84 FOUNDATION PILES

The Union Metal Mfg. Co.—Catalog No. 91 on Monotube foundation piles is available. In addition to general descriptive information, the catalog contains engineering data covering physical properties, specification suggestions and test loading; also, contractor data on concrete volumes and weights is included. Advantages listed are: light weight, easy handling, economical field extendability, visual inspection after driving, and highload carrying capacity with extra high economy per ton load supported.

85 FOUNDATION PRODUCTS

Armco Drainage & Metal Products, Inc.—Described in this 16-page catalog, FP-13559 are three basic types of foundation pipes—pipe piles, caissons, and Hel-Cor pile shells. Where used, wide variety of structures, selection of end closure are some of the subjects covered. The booklet includes tables, specifications, information on driving equipment, and pictorial case histories.

86 GALVANIZED STEEL FORMS

United Steel Fabricators—In this leaflet is described the fast erection, pre-fabricated, no stripping, topside erection, bolt attached, safety record and economy of the Steel Deck Forms. Special features include: tight fit forms, reducing leakage; closures and sections of forms to close all areas and quick erection with the attachment of four clamps, tightening four bolts and installing a metal joint seal for every 15 square feet of forms.

There are 260 Digest items on pages numbered 118 to 143. Read all items for the literature of interest to you.

87 GASKETS

Hamilton Kent Mfg. Co.—A 16-page technical manual in color, fully describes, illustrates and diagrams five different Tylox (℗) rubber and neoprene gaskets used for coupling any type of concrete sewerage and drainage pipe. Tylox physical properties, guides to engineers for writing rubber joint specifications, and tips to contractors on making rubber-jointed pipe installation are included.

88 GATE HOISTS

D. J. Murray Mfg. Co.—Catalog GH-353 describes gate hoists specifically designed to control water levels on hydro-electric power plant installations. Illustrations show some typical hoists and lists of types of stationary and travelling gate hoists for the power dam gates to which they are applicable.

89 GEAR DRIVES

Johnson Gear & Mfg. Co., Ltd.—Catalogs 31 and 32 contain engineering data on hollow and solid shaft gear drives for use in pump and industrial applications. Standard combination drives are listed in a wide range of models and ratios including the new automatic Redi-Torq combination drive which eliminates service interruptions due to power failures.

90 GENERATING SET

Katolight Corp.—Information is available on a new 125 KW generating set, developed to meet emergency requirements in modern industrial plants, institutions, hospitals and public buildings. The major features are the unitized compact design, available in all standard voltages equipped with either close regulating static or rotating exciters, and voltage regulators. In writing for further information, Katolight will send a complimentary copy of their "Life of the Party" songbook.

91 GEODETIC INSTRUMENTS

AGA Corporation of America—This 8-page brochure describes the Geodimeter, an electronic survey instrument used for accurate measurement of unknown distances, what it is, how it works and how it is employed. Detailed descriptions of Models 2, 3, and 4 are included, giving specifications and capabilities of each.

92 GKO LEVEL WITH ERECTING EYEPIECE

Kern Instruments Inc.—This model in the famous Kern Surveying Instrument line was especially designed for the U.S. market. In addition to the Erecting Eyepiece, the instrument is easier and more comfortable to operate and may be used on a Theodolite Tripod with an adapter plate.

Just Off The Press

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SYMPOSIUM ON PENSTOCKS

The fourth in the Proceedings Symposium Series has been issued. The discussions and closures for these papers, reprinted from the Journal of the Power Division, have been collated with the original 9 papers and the entire grouping is now presented under one cover.

The general aspects, as well as specific phases, of penstock design and construction are related. Designers and constructors have related their experiences in dealing with the common problems and recent developments involved in this vital field.

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CATALOG DIGESTS

93 GLASS LINED CLAY PIPE

American Vitrified Products Co.—A glass lined sewer pipe, called the most outstanding house-to-street sewer and house drain pipe for modern home requirements, is described in this 4-page booklet. Included are illustrations of advantages to this pipe, and a step-by-step illustration of installation procedures.

94 GRAIN STORAGE

Behlen Manufacturing Company—This 32-page illustrated booklet is a review of ASC and CCC regulations on grain storage on the farm. It is a farmers' reference handbook, explaining government loans, different types of grain storage structures and aeration and cleaning of grain while it is stored. The price is $.75.

N. B. There is a charge for this booklet. Please make check payable to the Behlen Manufacturing Company.

95 GRATING FLOORING AND TREADS

Irving Subway Grating Co., Inc.—General Grating Catalog F400 contains illustrations, full line of grating products made in steel, aluminum and other metals. Catalog shows riveted, welded and pressure-locked types for use as flooring, treads, walkways, trench covers, and so on. Irving grating is safe, durable, self-draining, ventilating, clean, fireproof and economical.

96 GRATINGS

Borden Metal Products Co.—A 16-page catalog shows the three basic types of grating construction; more than 30 dimensional drawings of subtypes; eight safeload tables covering steel and aluminum gratings, roadway grating and sidewalk slabs plus other tables on panel widths, tread widths, floor armor, etc. Also shown are the various safety treads and their nosings. Included are the steps for careful planning and checking of the job.

97 GRAVITY SEWER PIPE

Keasbey & Mattison Co.—Asbestos-cement gravity sewer pipe, designed for economical, long life non-pressure sewer systems, is described in a 4-page folder, AP-22. Profusely illustrated, it points up savings in design, installation and operation with asbestos-cement pipe. Complete dimensions, tolerances as well as other specifications needed by the engineer are included.

Please note our deadlines. Requests cannot be processed after these dates.

98 HEATED ASPHALT ROLLERS

L. B. White Company, Inc.—A bulletin describing the Hotteroll Asphalt Roller is offered. The small hot roll gives 5-ton compaction with the heat reflowing asphalt producing better sealing. It has a preheater allowing for cold asphalt to be re-heated and rolled. Specifications and illustrations are also given.

99 HEAVY-DUTY CONCRETE TOPPING

Kalman Floor Company—A 24-page booklet describes the method of installing heavy-duty concrete topping with Kalman Floor Company's Absorption Process®. This process involves a hydraulic densification of topping to achieve utmost density.

100 HEAVY DUTY TRAILERS

Birmingham Manufacturing Company, Inc.—In this 28-page No. "E" catalog is found the information concerning deck-space, specifications for all types of hauling, parts, deck heights, and wheel sizes, etc. An extra strong gooseneck providing for a greater resistance to twist and long wear is also offered. There are trailers to suit all purposes and for all types of loads.

101 HIGH STRENGTH BOLT

Russell, Burdsall & Ward Bolt and Nut Co.—Savings of up to 40% in bearing-type connections can be achieved through the use of a new high strength bolt described in this 8-page reference bulletin. The larger head and shorter thread length of the new bolt design offer substantial advantages: for erectors, savings in fastening time and materials cost; for fabricators, faster and less expensive production; for designers, specified shear strength with reduced number of bolts. Contains useful specifying information.

102 HIGHWAYS AND STREETS CATALOG

American Steel & Wire—Here under one cover is the description of products for use in highways and streets. Products included are: Welded Wire Fabric, Transverse Road Joint Load Transfer Assemblies, Multisafty Cable Highway Guard, Beam Guard, steel and wire products for Prestressed Concrete, and Reinforced Concrete Pipe, American Welded Wire Fabric for tunnel and bridge construction and for bituminous concrete road repairs.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

103 HOIST

Mayco Tubular Structures Corp. of America—A brochure is offered describing the new Jumbo portable hoist. With the bucket or concrete bucket, it lifts 3000 lbs, yet is fast in raising, travelling 150 feet per minute to heights over 200 feet while lowering in one minute. It can be towed away by any car without disassembly and it is automated to run without maintenance because of its oil-sealed system.

104 "HOWELL-BUNGER" VALVES

Allis-Chalmers-Hyd. Division—These valves provide easy, efficient regulation and control of water under free discharge as so illustrated in this 14-page booklet. The valve is installed at the free end of a pipeline or conduit and discharges either into the atmosphere or into the water.

105 HYDRAULIC TURBINES

The James Leffel and Company—New data sheets give information on turbine installations at the Niagara-Mohawk Power Company's prospect development; at the Bureau of Reclamation projects; at the Girshik power plant in Afghanistan; and at the Arkansas Power and Light Company's Remmel Dam power plant.

106 IMPROVEMENT OF WATER FACILITIES

Cast Iron Pipe Research Association—By writing on their business letterhead, engineers concerned with water utilities may have a copy of this association's book "Water—Make Sure You'll Always Have Plenty." Prepared to acquaint civic leaders with the seriousness of the community water problem, it gives a step-by-step outline of what citizens can do to help improve community water facilities by working with water utility executives.

107 INCINERATOR

Morse Boulger, Inc.—Bulletin No. 185 has just been issued showing incinerators designed to serve the special needs of apartment houses, banks, restaurants, cafeterias, clubs, etc. Useful data includes average weight per cubic foot of various types of wastes, dimensions, capacities stated in lbs. per hour, the diameter and height of any stack required and recommended maximum load allowances for different types of buildings.

108 INTERFERENCE BODY BOLT

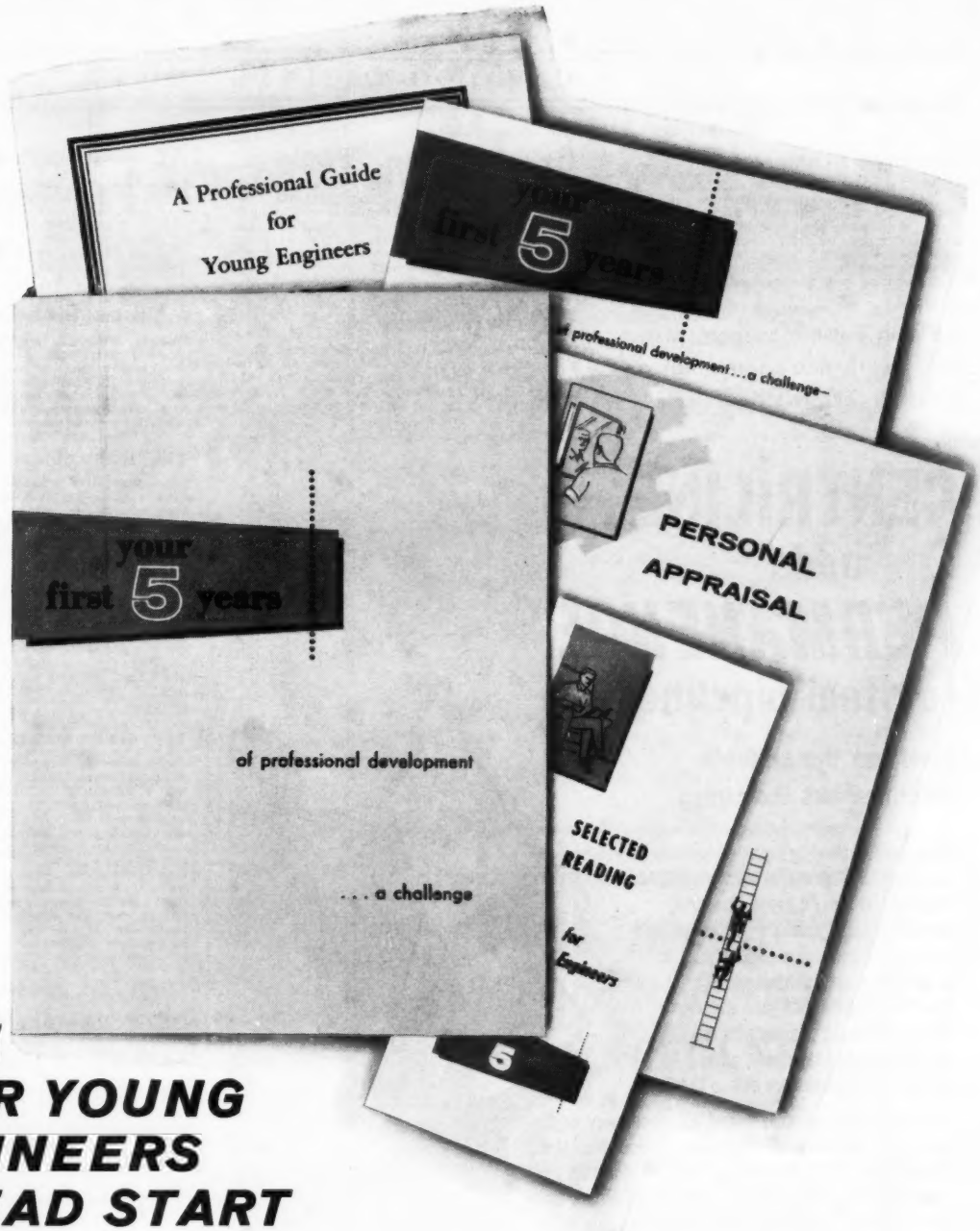
Automatic Nut Company—Descriptive literature on this new type of bolt with interrupted ribs is now available. The bolt meets the necessary specifications of the A-325 and has been approved by foundations and institutes. It gives high clamping force as well as body-bound fit and higher valves that permit fewer bolts for certain connections.

109 IRON PIPE, TUBING AND FITTINGS

American Cast Iron Pipe Co.—Catalog L-127 describes the complete line of American ductile iron pipe, tubing, casings, fittings, and special castings. Included is valuable information: grades, specifications, dimensions, and weights. Typical applications include underground piping, industrial piping, well casing, and many others.

110 JOINT PIPE

U. S. Pipe & Foundry Company—An 8-page booklet is offered on Usiflex boltless flexible joint pipe. The joint is simple, rugged, locked against pull-out and assembled without the use of bolts. Ideally suited for submarine installations.



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111 KON-X BEARING PADS

Keasbey & Mattison Co.—A data page is offered describing bearing pads composed of asbestos fibers in combination with a synthetic rubber elastomer. They are ideal as pads under prestressed concrete beams placed over abutments. Resiliency is maintained despite extremes in temperature. The data page details other uses as well as physical parameters.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

112 LARGE FASTENERS

Joseph Dyson & Sons, Inc.—An engineering guide for selecting large fasteners and construction accessories is available in Bulletin 1260. It lists complete specifications for threaded rods, clevises, turn-buckles, coupling nuts, sleeve nuts and describes typical applications of special fasteners.

113 L-E-VATION ROD

Lenker Mfg. Co.—A brochure is offered on a new designed leveling rod on which all elevations are read direct. All computations are eliminated. Measurements are given in feet and tenths or in the metric system.

114 LIGHTWEIGHT PIPE & FITTINGS

Naylor Pipe Co.—Bulletin No. 59 illustrates and describes spiralweld pipe for construction uses. Push-pull ventilation, high and low pressure air and water lines, dredging pipe, etc. in diameters from 4 to 30 in. It includes standard fittings, welded flanges, one-piece Wedgelock couplings, and connections for a pipe line requirements.

115 LIQUEFIED PETROLEUM

Chicago Bridge & Iron Company—Storage of liquefied petroleum gases at extremely low temperatures is the subject of this 16-page brochure. It includes descriptions of double wall storage vessels, insulation systems, materials of construction and accessories, plus illustrations of cryogenic storage vessels.

116 LIQUID CONCRETE ADMIXTURE

Johns-Manville Products Corporation—A 32-page catalog is available on air-entraining Placewel, which when added to the mix, produces outstanding properties in the plastic and hardened concrete. It will yield from 3 to 6% of entrained air, while reducing the water-cement ratio for a given consistency by 15%, in any properly designed concrete mix. When added to a concrete of given consistency, it will provide marked improvement in workability and placeability; greatly increase compressive strength and durability while reducing bleeding and segregation. Non air-entraining Placewel is a straight liquid, water-reducing agent which, when added to concrete, greatly improves workability, durability and strength.

117 LIQUID RETARDER

Johns-Manville Products Corporation—A 16-page technical bulletin is offered on Retardwel, a retarding admixture for concrete. Architects, engineers and others concerned with construction will find the data and reports of interest. They show how Retardwel aids in overcoming problems that are inseparable elements of any hot weather concreting operation. Retardwel permits a reduction in the water required for proper placing and therefore provides the advantages that are inherent in concrete fabricated with a minimum paste content. Its use delays the initial set of concrete and provides a slower rate of heat evolution, thereby minimizing thermal stresses.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

118 METAL FABRICATION AND CONSTRUCTION

Pittsburgh-Des Moines Steel Co.—A 36-page General Brochure describes the capabilities and diversities of PDM Metal Construction. The facts presented serve as a useful measure of the highly developed knowledge and craftsmanship of the company in engineering, research, fabrication and construction of steel, stainless steel, stainless clad steel, alloy and aluminum.

119 METAL ROOFS AND WALLS

Behlen Manufacturing Company—This bulletin describes and illustrates the economy made possible by Behlen Dubl-Panl. The simple bolt-together construction cuts erection time, fewer and lighter materials reduce handling problems, one-step construction, insulation provides economical high thermal values and all components of the roof are galvanized or aluminized.

120 MINIATURIZATION

Charles Bruning Company, Inc.—A unique Retrievable Miniaturization system is detailed in a new 8-page illustrated booklet. It provides miniaturization without sacrificing readability, the costs of blue-prints and/or diazoprint materials can be reduced up to 300% and the capacity of this equipment can be increased up to 4 times by the process.

121 MINING MACHINE

The Eimco Corporation—Details of the 24 Rocker Shovel are contained in Bulletin L-1140-A. The bulletin explains the new loader arm with its patented, enclosed bumper springs, greater cleanup widths and mucking capacity, the larger bucket and expanded range of discharge height. Complete specifications are included.

122 MOLOX BALL JOINT PIPE

American Cast Iron Pipe Company—Molox Ball Joint Pipe for rivercrossings and other submarine service is the subject of a revised 32-page illustrated catalog. It contains instructions for assembly, weights and dimensions, tables and various installation procedures.

123 MOTOR GRADER AND VIBRATORY COMPACTOR

The Galion Iron Works & Mfg. Co.—A combination grader and vibratory compactor is described in this bulletin. The compactor delivers 4200 deep-penetrating compacting blows per minute and leaves the surface smooth and flat, with no waves or "washboard" effect. It is easily removed to permit full grader operations.

124 THE M-SCOPE

Fisher Research Lab., Inc.—This 14-page bulletin illustrates and describes the versatility of a transistor operated scope. It traces pipe and cable, manhole cover locations, and detects leaks. The operation of this instrument is simple and economical with an indestructible fiberglas case and trouble free maintenance due to the simplicity of the design.

125 NEW DIESEL ENGINES

Allis-Chalmers Mfg. Co.—Features of the Models 10000 and 11000 diesel engines are described in the eight page catalog, BU-718. Performance curves, charts, and illustrations, including cutaways of important components are included to illustrate these two new engines in the 100-210 hp class.

126 OPEN STEEL BRIDGE FLOORING

Kerrigan Iron Works, Inc.—A catalog on Greulich 4-way Grid, 5-in. depth, contains illustrations, full engineering data including properties and load tables. The pamphlet explains the ease of filling half depth with concrete where needed, economical, speedy field erection, and why 20% fewer field welds are needed. Grid fabricated in panels 7-ft 3-in. wide with lengths up to 42-ft.

There are 260 Digest items on pages numbered 118 to 143. Read all items for the literature of interest to you.

127 OPTICAL PLUMMET TRANSITS

Fennel Instrument Corp. of America—Information on the transits and self-leveling levels, including latest developments, are given in a new 12-page folder, which also covers a complete line of instruments of both American and European types from builders levels to one min. and one second Theodolites.

128 O-RING VALVE

M & H Valve and Fittings Company—An iron body hub-end, O-Ring valve, has been developed for use with concrete pipe without the use of adapters. This permits a savings in installation expense and cost of adapters. Descriptive circular No. 26 is available upon request.

129 PACKAGE SEWAGE TREATMENT PLANTS

Walker Process Equipment Inc.—Sparjair units range in capacities from 50 to 5000 pop. equiv. to offer complete treatment plants for housing developments, motels, shopping centers, etc. This package type plant produces a clear, nuisance free effluent through the contact stabilization process. Theory, operation, design factors, specifications and details are covered in bulletin 19-S-94.

130 PAYHAULER

International Harvester Company—A 4-page brochure is offered on the Payhauler 19 and 27-ton models. Its features include revolutionary rock-ribbed bodies, 30% less body deadweight; 14% faster haul speeds when horsepower pays off and new 375 and 250-hp diesel engines.

131 PAYSCRAPER

International Harvester Company—A 24-page booklet is offered on the 295 Payscraper. Some of its features include rack-pinion steering system with tandem pumps that deliver equal steering response through the full course of any turn; the 295 gives a new job-proved 375-hp turbocharged diesel; and the payscraper pairs perfectly with any single engine pusher within the 131-in. cut. On the fill it's the tapered bowl, positive ejection 98-in. apron opening and no front bowl cross member that combine to pour out payloads in record time. Also available is a booklet on the 495 Payscraper and 495 Paywagon.

132 PILES

Raymond International Inc.—Standard and step-tapered piles are described in Catalog S-61 which also includes information on the scope of Raymond's activities covering every recognized type of pile foundation. Domestic operations include harbor and waterfront construction, and cement-mortar lining of pipelines in place. Raymond's services abroad also include all types of general construction.

Please give your complete address.

133 PNEUMATIC-TIRE ROLLER

The Galion Iron Works & Mfg. Co.—Bulletin No. 434 gives complete information and specifications on the Galion 12-ton, 9-wheel pneumatic-tire roller. Illustrations clearly explain the exclusive Equamatic front end construction of the roller. This construction is claimed to provide, through the automatic equalizing action of triple king pins, utmost operating stability and balance for the roller when working over uneven and sloping ground.

134 PNEUMATIC TOTALIZER

B-I-F Industries—This device multiplies flow rate by time to give total flow. It receives a linear or square root pneumatic signal between 3 and 15 psi and converts this air pressure into direct readout of total flow in volumetric units on a cyclometer-type totalizer. Being self-contained it requires only an input air signal and electrical power connections. More information is available upon request.

135 POCKET PENETROMETER

The Testlab Corp.—This penetrometer is designed to be used as a field check for classifying various soil types merely by inserting this tool into the soil and measuring resistance to the penetration. The calibrated spring is completely enclosed in the body and cannot come in contact with soil unless it is disassembled. More information is available upon request.

136 POCKET TRANSIT

William Ainsworth & Sons, Inc.—Information is available on the Brunton Pocket Transit, which is widely used for reconnaissance and preliminary surveying on the surface and underground, for taking topography, and for geological field work. In addition to taking horizontal and vertical angles, it may be used as a prismatic compass, level, clinometer, plumb or alidade. Essentially the transit is a magnetic needle set in an accurately graduated circle in a case which opens into a versatile sighting arrangement. A level is attached to a vernier for reading vertical angles.

137 POOL INSTALLATIONS

National Pool Equipment Co.—A 16-page commercial pool brochure, in full color, features many of the outstanding public pool installations throughout the U. S. It highlights motel, community, club, military and university pools with general lay-out in sizes.

138 PORTABLE FIELD AND JOB OFFICE

Porta House—This portable field or job office, used for years by many Western engineering firms, is described in a catalog. The Porta House is made of bolted, waterproof panels, prefabricated from marine plywood, and comes with as many doors and windows as you want. Available from 6 ft by 9 ft up to any size in 3 ft modules, it is quickly assembled or disassembled and easily transported on a pick-up truck. Included are installation illustrations and lists of prices and sizes. Available in Western states only.

139 POZZOLITH, MASTERPLATE AND EMBECO

The Master Builders Company—Two 1960 catalogs, one general and the other industrial, contain performance data and guide specifications for Master Builders products for the improvement of concrete and mortar. Some of the products included in these booklets are: Pozzolith, for the positive control of concrete quality; Masterplate, for longer-lasting concrete floors; Embeco, for non-shrink grout, concrete and mortar; and Omicron Mortarproofing, for control of mortar qualities.

Turn to page 118 and order your literature.

140 PRECAST CONCRETE BRIDGE MEMBERS—AMDEK

American-Marietta Co.—An 8-page folder shows how Amdek prestressed, pretensioned concrete spans revolutionize bridge construction methods. It also illustrates skew beam tests, load distribution tests and tests to destruction being conducted in independent laboratories.

141 PRE-ENGINEERED SECTIONAL BELT CONVEYOR

Stephens-Adamson Mfg. Co.—Bulletin 458 is offered on the new Pre-Engineered Sectional Belt Conveyor. It features comprehensive technical data, pre-engineering advantages and an exploded view of the Sectional Belt Conveyor with all the quality components called-out.

142 PREFABRICATED ASPHALT LINING

Gulf-Seal Corp.—The fourth edition of the Engineering Brochure presents dependable prefabricated asphalt lining. Included are installation details, specifications and photographs of numerous installations. The tough, flexible lining solves many problems involved with the storage of industrial salt water and waste chemicals, municipal treated and untreated water, and in restoring to efficient service steel and concrete reservoirs.

143 PRESSURE PIPE

Keasby & Mattison Company—A 4-page folder, No. AP-27 is now available. It describes "K & M" Asbestos-Cement Pressure Pipe with patented Fluid-Tite® coupling. Illustrations show the uses and methods with technical information and specifications also provided.

144 PRESTRESSED CONCRETE

American Steel & Wire—A 56-page catalog, illustrates up-to-date applications of prestressed concrete as a construction material for bridges, pressure pipe, buildings, storage tanks, etc. It covers both pretensioning and posttensioning with specific data on U. S. Steel Super-Tens Stress-Relieved Wire and Strand and High-Strength Large-Diameter Strand and Strand Assemblies.

145 PRESTRESSED CONCRETE MEMBERS

John A. Roebling's Sons Div., The Colorado Fuel and Iron Corp.—The rapid growth in the use of precast, pretensioned bonded prestressed concrete members, confirms their several advantages over competitive materials. Bulletin PC-945 describes application and productions, and covers buildings, bridges, piles, casting bed details, and tensioning data. Fully illustrated.

PLEASE BE PATIENT

YOUR REQUESTS TAKE TIME

146 PRESTRESSED CONCRETE PILES

Raymond International Inc.—Catalog CP-3 describes and illustrates Raymond cylinder piles of prestressed concrete. Information is given on the merits of prestressed concrete piles for foundations of bridges, waterfront and off shore structures. Shown are many examples of installations and suggested designs.

147 PRESTRESSED CONCRETE TANKS

The Preload Company, Inc.—A new 12-page brochure covering the design, construction and application of prestressed concrete tanks is now available. Included is a brief description of their use for water storage, chemical and petroleum product storage, water treatment and sewage disposal tankage and as pressure cylinders for liquid gases.

148 PRESTRESSED CONCRETE TANKS

The Preload Company, Inc.—A special 4-page bulletin, No. T-14, covers the design, construction and use of circular prestressed concrete tanks in the petroleum industry.

149 PRICELESS WATER

Johns-Manville—This 84-page book presents the need for good water service throughout the nation. It demonstrates the need for good facilities: their benefits to the individual, community, business and industry. It offers an extensive check list for evaluation of present water utility, and, a step by step outline of what can be done to promote and obtain good water service. Informative and educational, this book is concerned with resources, facilities, personnel and public relations.

150 PUMPING STATIONS

Zimmer & Franceson—Completely prefabricated Underground Pumping Stations, in a range of sizes to suit all applications where extensions to sewer systems require that the flow be raised to the level of existing mains, are described in this 8-page bulletin. Engineers and contractors for sub-divisions, shopping plazas, industrial sites and similar projects will be interested in the automatic operating features and simple installation requirements of these stations.

CATALOG DIGESTS

151 PUMPS

Pacific Pumping Company—Bulletin 1004 is an illustrated table of contents of the complete Pacific Pumping Company catalog, picturing each of the many types of industrial and farm pump built by the company, with a brief summary of the purposes, sizes, heads and capacities, available. Bulletin 1800.9 describes the recently developed type SA contractors submersible dewatering pump.

152 RADIUS WALL FORMING

Gates & Sons, Inc.—Complete diagrams for radius forming including bracing, pre-warping of panels, tie spacing, filliers and battens are in this brochure. It also illustrates the construction of small diameter tanks and special applications concerning the construction of all round walls.

153 RAMMER

Wacker Corporation—The Wacker Rammer does compacting on all types of backfill easily and efficiently. It was developed to meet compaction requirements on clay, sand, silt, granular and bituminous materials. The machine has a self-propelling action which makes it easy to handle by one man and requires little more than a guiding action. More information is available on request.

154 RECORDER

Leupold and Stevens Instruments, Inc.—Bulletin 24, describes the re-designed Type F Stevens Recorder, used for recording fluctuations of any liquid surface, such as, ground water levels in deep wells, for stream gaging, irrigation, water supply, sewerage and oil production. It contains 8 pages of illustrations plus the description of the field interchangeable clock drive and the Stevens type FM Weight Driven Recorder.

155 REINFORCED CONCRETE PIPE

American Steel & Wire—This 13-page booklet gives the complete story of the development and installation of concrete pipe. It features the ASTM Specification Development, the D-Load Concept, comparison of the new specification with the old, bedding, width of trench and usage criteria.

156 REINFORCED CONCRETE PIPE—HI-HED

American-Marietta Company—A pamphlet containing many photos showing how elliptical Hi-Hed Reinforced Concrete Pipe saves trench width in congested areas and has up to 50% greater strength than its round pipe equivalent. Includes charts on headwall details, physical characteristics and hydraulic properties and discharge graphs. Also folder on elliptical Inner Circles Pipe illustrating quick passage of pipe through pipe underground without disruption of surface traffic.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

157 REINFORCING BARS

Bethlehem Steel Company—The complete description of reinforcing bars, including the new high-strength bars; economics in construction resulting from the use of high-strength bars; plus descriptions of the large-size 14S and 18S bars; welding techniques; and identification of all types, is found in the 12 page booklet, No. 583.

158 REPRODUCTION MACHINE

Ozalid Division of General Aniline & Film Corp.—A new bulletin, "Whiteprint Copies For Every Use" is now available. It describes processes, materials, machines and applications.

159 RESIN MAINTENANCE MATERIALS

Topkote Products—Product data sheets give complete product description, application instructions and prices for LP/Epoxy Resin formulations for the maintenance and repair of highways, bridges, buildings, dams, airport runways, etc.

160 RIG—DOUBLE-DUTY

Acker Drill Co., Inc.—offers free of charge Bulletin 31-ST and Bulletin 31, both of which describe the skid mounted and truck mounted Acker Presidente high capacity double duty rig for auger boring or core drilling. The unit has a capacity to auger down to depths of 300 feet and will core to 4500 feet.

161 "RING-JET" VALVES

Allis-Chalmers-Hyd. Div.—For easy regulation and control of water under free discharge the Ring-Jet valve cuts objectionable spray to a minimum, keeps operating mechanism in the dry and reduces space requirements. The bulletin offered, illustrates the simplicity of construction and easy operation of the valve plus the overall dimensions, discharge characteristics, typical settings and specifications.

162 ROLLING DOORS

Kinnear Manufacturing Co.—According to this catalog #109, these rolling doors meet nine major requirements: "Registered" life extension; quick, easy operation; space saving; greater durability; fire protection; maximum safety; general protection; neat appearance; and economical installation. Steel rolling service doors, steel rolling fire doors, and bifold doors are a few of the rolling doors discussed in the catalog. Also included are specifications, photographs and an index to door types.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

163 ROOF FRAMING MEMBERS

Macomber, Inc.—Now available is a 32-page design manual on new roof framing members called V-Purlins. Design information, deflection calculations, dimensions, load tables and bridging information are combined with general construction details for spans to 120 feet.

164 ROOF STRUCTURES

Fluor Products Co.—The roof structures presented in this 24-page booklet include: glued laminated structural lumber, beams, arches, lamella roofs, glued laminated wood purlins and bowstring trusses. The booklet is completely illustrated with photographs of applications for the different structures.

165 ROTOVALVE

Allis-Chalmers-Hyd. Div.—A 64-page booklet features the Rotovalve with its many distinct advantages. It offers flexibility for the jobs, positive closure, greatest initial shut off, and greatest control of closing time. Three-point bearings permit exact alignment of plugs, body and operating mechanism and the "S" mechanism seats contact in the open position allowing if necessary the repacking of the valve under pressure when in service.

166 SANDHOG EQUIPMENT

Mayo Tunnel and Mine Equipment—Many types of tunnel shields, man lock, muck locks, tunnel cars, lock doors and grouters or pea shooters are shown in the 4-page bulletin No. 23a. Equipment is illustrated and described in many installations throughout the world.

167 SEEPAGE & POLLUTION CONTROL

Gulf-Seal Corp.—The fourth edition of this brochure explains in detail how cities and industries overcame difficult problems in seepage and pollution by using flexible asphalt sheets in drinking water reservoirs, salt water pits, canals and industrial waterways. The brochure is illustrated with detailed step-by-step photos.

168 SEISMIC EXPLORATION

Geophysical Specialties Company—This illustrated 8-page booklet, explains the techniques of seismic exploration using the self-contained, portable MD-1 Engineering Seismograph. It gives a chart developed by leading equipment manufacturer which shows ripper performance as related to seismic wave velocities and shows how seismic analysis protects profits on jobs based on firm bids by indicating depth of overburden, ripability of rock and depth to bedrock.

169 SELF-LEVELING LEVEL

THS Company—The new automatic level with spherical head, quick-setting tripod is described in an 8-page folder. Also included is data on THS Transits, Transit-Levels, Dumpy Levels, Tilting Levels, Hand Levels and other instruments and accessories.

170 SELF-LEVELLING LEVELS

Texas-Asiatic Import Company—This folder describes the Filotecnica Salmoiraghi automatic levels. The engineers model 5173 and the first-order model 5190, level the line of sight within 2 seconds and 3/10 of one second respectively. Other features include 10' bulls-eye vial visible in telescope field, dual purpose metal case, and simplified crosswire adjustment.

171 SEWAGE REGULATORS

Brown & Brown, Inc.—manufactures a line of float controlled quadrant gates, in 37 sizes, to automatically control the diversion of sanitary flows from combined sewers to interceptors. Such automatic gates may be actuated either from head or tailwaters or dually from two sources. Bulletin 81A contains capacity and dimension charts.

172 SEWAGE TREATMENT PLANT

Smith & Loveless—A new bulletin on "Oxigest" sewage treatment plant contains design details, installation information, a simple explanation of the aerobic digestion process and a representative list of installations. The color bulletin contains photographs of "Oxigest" installations.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

173 SIMPLE-SPAN BEAM

John A. Roebling's Sons Division The Colorado Fuel & Iron Corp.—Engineering Bulletin PC-946 is entitled "Design Procedure for a Simple-Span Prestressed Concrete Beam." Its contents are based on ACI-ASCE Committee 323 report "Tentative Recommendations for Prestressed Concrete." It is an excellent guide for engineers designing prestressed concrete members.

174 SKID-SHOVEL

International Harvester Company—Two 16-page booklets are offered on the 4-in-1 Skid-Shovel, which is 4 prime construction units—a bulldozer, scraper, skid-shovel and clamshell. Basically, it consists of a super-strong, 2-segment bucket which can be positioned four ways. Each of the four "machine selector" settings forms an efficient, specialized piece of equipment. Change-over from one unit to another takes only a second or two.

175 SLIDE RULES

Keuffel & Esser Co.—The scales, functions and limitations, as well as a description, of standard slide rules are offered in this 24-page catalog. In addition, pictures and specifications of K&E's full line of slide rules in mahogany and plastic are presented, ranging from general purpose to special purpose, Decitrig to Mannheim, standard to pocket sizes. Not an instruction booklet, the catalog serves as a general introduction to the use of slide rules.

176 SLUICE GATE CATALOG

Rodney Hunt Machine Co.—This new, 212-page catalog presents the full line of sluice gates and auxiliary water and sewerage control equipment manufactured by the Rodney Hunt Machine Co. It covers more than 3,000 combinations of types and sizes of sluice gates, as well as hoisting equipment, fabricated gates of metal and wood, valves, regulators, etc. Available to qualified professional engineers involved in the design and specification of sluice gate installations. Please request on your company letterhead.

177 SLURRY SEAL

American Bitumuls & Asphalt Co.—"Bitumuls Slurry Seal" is an operation which consists of mixing the aggregates with Bitumuls and water to a slurry consistency in a transit mixer, and spreading over the pavement by a specially constructed squeegee type spreader-box. The action of the squeegee forces the slurry into the fine cracks of a weathered but still sound surface of an old asphalt pavement, thereby reducing expensive maintenance patch construction to a minimum.

CATALOG DIGESTS

178 SOIL COMPACTION

Vibroflotation Foundation Co.—Available is a booklet entitled "Soil Compaction by Vibroflotation" which describes the soil consolidation and engineering services of the Vibroflotation Foundation Co. The booklet illustrates the compaction of 8 to 10-ft cylinders of sandy soil to provide a firm foundation of sand for any type of structure. To make sure of complete coverage in a given area, these cylinders are overlapped according to a predetermined pattern under individual loadings or under entire building areas.

179 SPACE SIMULATION FACILITIES

Chicago Bridge & Iron Company—A 4-page bulletin shows CB&I's ability to take responsibility from conceptual design through start up of space simulation facilities for aircraft, missile and human factor research. Also described are the composite metal Horton clad, heat sinks, solar systems and vacuum pumping systems.

180 SPEED DRAFTING

J. S. Staedtler, Inc.—A comprehensive 24-page catalog presents a wide variety of items designed to make it easier for engineers, architects and draftsmen to execute drawings with good reproducing qualities.

181 SPLICER

Associated Pipe & Fitting Company—Illustrated in this leaflet are the step-by-step details of assembly of the Steel H-Beam Bearing Pile Splicer. Some advantages include: a sleeve to drive multiple lengths so that the average pile driving equipment can be used, less welding is required thus cutting time and expense and the sleeve will support the beam during the operation thus making available the other equipment.

Return the coupon today!

182 SPRAYED-ON FIRE PROTECTION

Keasbey & Mattison Co.—Folder SL-8 gives up-to-the-minute information and technical data on Sprayed "Limpet" Asbestos, including results of its most recent fire tests. Its application to metal beams and columns as well as to cellular steel floors is illustrated and fire ratings listed for each type of use. Sprayed "Limpet" Asbestos now offers protection from flames up to five hours depending upon the thickness of the blanket.

183 STEEL CONSTRUCTION

Yuba Consolidated Industries, Inc.—A new bulletin, YSC-260 titled, "Steel Construction and Field Erection Services", shows the broad range of Yuba capability that provides nationwide service in steel construction, equipment installation and industrial maintenance. Photographs illustrate unusual projects while structural plate steel construction and reinforcing bar jobs are described.

184 STEEL CONSTRUCTION PRODUCTS

Inland Steel Company—The catalog offered includes sheet piling, bearing piles and tees, structural shapes, carbon steel plates, subpurlins and 4-way safety plate. Two special sections discuss structural shapes, with regard to chemical composition, typical properties, specifications, etc. and the ASTM specification "A-36", with its minimum yield point of 36,000 psi.

185 STEEL FORMS

Food Machinery and Chemical Corp.—Form-Crete Steel Forms for precasting reinforced or prestressed concrete are designed to produce the highest quality finished product. This 20-page bulletin describes the many types of Form-Crete Steel Forms, and gives applications and specifications for the different forms.

186 STEEL GRANDSTANDS

Pittsburgh-Des Moines Steel Company—A 4-page illustrated folder thoroughly describes construction, design factors, seat spacing, aisle width, specification check points and over-all advantages of these permanent stands for outdoor seating. Formulas for calculating seating capacities are provided, and capacity tables. Types of stands pictured include school, racetrack, baseball and fairground structures. Unit construction and adaptability are features of PDM Steel Grandstands.

187 STEEL GRATING AND STAIR TREADS

Kerrigan Iron Works Co.—Because of a new arrangement of standard, close spaced and tread data, this bulletin makes it easier for the reader to find specific types of grating. Included in File No. 14-R are complete tables on safe loads and weight.

188 STEEL POINTS

Associated Pipe & Fitting Company, Inc.—The Pruyn Heavy Duty cast steel points which guard against deformation and strengthens the H-Beam Pile is illustrated in this leaflet. The point is made of high carbon steel, tough and strong enough to withstand the abrasive action of all obstructions encountered in the hardest soil.

189 STRAIGHT CHORD STEEL JOISTS

Laclede Steel Co.—This catalog covers steel joist construction, Laclede joist standards, steel joist design tables, construction accessories and steel joist specifications. The 52-page catalog is well illustrated with pictures of the various kinds of joists as well as some applications.

190 STRATAGRAPH

Edo Corp.—An illustrated brochure describes the Model 400 Stratagraph, strata penetrating sonar which records, with sharp definition and complete accuracy, formations underlying rivers, lakes and other relatively shallow bodies of water. Sediment, intermediate layers, bed rock and faults are readily distinguished and pictorially shown on permanent chart. The brochure illustrates equipment and typical recordings.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME

191 STRUCTURAL ADHESIVES

Adhesive Engineering—A general booklet called "Where . . Why . . How to use Concresive Epoxy Structural Adhesives" is now available. Explanations are given on the use of four other concresive pastes. Concresive #1 is a mortar used for patching and repairing cracks and spalled joints in pavements; #2 is used for concrete pipe repairs and vertical crack filling; #3 and #4 do essentially the same job as #1 and #5 is similar to #2. Also offered is information on Glasshesive, used for bonding glass to glass, and Methiesive, used for metal repair. Individual bulletins are available on each.

192 STRUCTURAL INFORMATION

The Ronald Press Company—offers a package of descriptive circulars on authoritative books for civil engineers. Subjects covered include: air conditioning, soils engineering, substructive analysis and design, structural design in metals, linear structural analysis, statically indeterminate structures, nondestructive testing, tensor analysis, and principles of engineering economy.

193 STRUCTURAL PLATE PIPE

Armco Drainage & Metal Products, Inc.—This catalog, MP-1660 gives technical data on Armco Multi-Plate Pipe, including description of plates, method of asembly, bolts, foundations, headwalls, shop-ellipsed pipe, field strutted pipe, and back filling and tamping. Useful tables and graphs are included, with photos of representative installations.

194 STRUCTURAL SEALING

Thiokol Chemical Company—A 4-page folder, No. S8100, describes the polysulfide base for building sealants, their properties, applications and techniques. It is illustrated while being used in sealing curtain walls, flashing, roofing and flooring. Also included is a section on the specifications of these sealants.

195 STRUCTURAL WELDING

Saxe Welded Connections—The manual offered covers Structural Welding Specification Requirements, Welding Symbols and their application, Theory of Welded Connections and the Theory of Continuity and Rigid Frame design. There are complete comparative cost studies and all of the information that an engineer would require to design a welded structure.

196 SUBMERSIBLE PUMP

The Deming Company—Bulletin 6710-20 describes this highly efficient and space saving pump. The noise is reduced and there is practically no maintenance problem due to the fact that the pump is submerged in the water with only the controls above ground.

197 SURFACE TREATMENTS

American Bitumuls & Asphalt Co.—"Bitumuls Surface Treatment Manual" is a two-color, 64-page round-up of factual, practical information on all phases of this type of pavement maintenance. Of special note is the attention given to proper evaluation of pavement distress ahead of specifying type of treatment. The manual is heavy on the "how-to" aspects of treatments, from "Black Seal" through "Armorcoats." Other features include a "Glossary of Terms" and a section of useful tables.

198 SURFACING COMPOUND

American Bitumuls & Asphalt Company—Completely illustrated booklet describes use of factory-made Walk-Top for colorful moisture sealing and smoothing of pavement surfaces on playgrounds, walks, and driveways.

Please note our deadlines. Requests cannot be processed after these dates.

199 SURVEY DEPTH RECORDER

Edo Corp.—Literature describes and illustrates new Model 555 Survey Depth Recorder, an improved sonar equipment for charting water depths from 1½ feet to 230 fathoms. New design features assure exceptional accuracy and definition of recordings. The equipment is lightweight, for permanent or temporary installment aboard vessels of every size.

200 SURVEYING INSTRUMENTS

Fennel Instrument Corp. of America—A low priced Optical Plummet Transit and Self-Leveling Level, one second and one minute theodolites, enclosed and standard A and U frame transits, tilting levels, 18-in. levels, convertible transit levels, and builders levels, are covered in a new group of leaflets and a catalog folder.

201 SURVEYING INSTRUMENTS

C. L. Berger & Sons, Inc.—A series of descriptive folders illustrating surveying instruments is now available. General characteristics are fully described with essential specifications for each instrument. Also available is a colorful brochure describing the all new plumb bob, the Berger Twin-Point Retracta-Bob.

202 SURVEYING INSTRUMENTS

Kern Instruments, Inc.—A 32-page brochure offers a brief description of the most important instruments manufactured by Kern & Co., Ltd., of Aarau, Switzerland. Fully illustrated, it acts as an index to the detailed literature available on each instrument. Included in the brochure are theodolites, levels, self-reducing tachometers, alidades, pentagonal prisms and many other instruments.

203 SURVEYING INSTRUMENTS

W. & L. E. Gurley—The complete line of Gurley surveying and engineering instruments, including transits, levels, alidades, are described in the revised edition of Catalog 50. Transits described include the Hall Gate Precise Transit; Standard Precise Transit; Gurley Telescopic Solar Transit; Standard Precise Mining Transit; Optoplane Precise Transit for industrial use; Optical Plummet Transit. Included are cross-sectional drawings of many of the transits. Please write on letterhead.

204 TALKABILITY

Globe Electronics—A pamphlet explaining a new FCC approved communication frequency —the Citizens Band and three new Citizens Band two-way radios, is now available. They feature tunable channel selection for receiving, exclusive rechargeable battery, pi-network and no license is required unit-to-unit.

205 TANDEM ROLLERS

Essick Manufacturing Company—Model 1200, 8 to 12 ton and Model 1400, 10 to 14 ton are featured in this bulletin. They feature totally enclosed reduction gears, highest curb clearance, compression and guide rollers, trouble-free yoke and king pin, extra heavy duty clutches, easier handling-positive control and uniweld construction.

206 TANKS

Graver Tank & Mfg. Company—This 34-page book tells the "Tale of Two Tanks" in the cities of Joliet, Illinois and Chicago, Illinois. The growth of the population required tanks for the supply of water both above and beneath the ground. It also introduces the new Cylindrod tank for large volume, low-cost storage.

Return the coupon today!

207 TECHNICAL PAPER

Clearprint Paper Co.—Some of the products contained in this booklet are: Clearprint 1000H, a technical paper for drawing and tracing; Papercloth, a technical paper of cloth durability; graph paper; and Fade-Out paper. Price lists and specifications are also included.

208 TECHNICAL PAPERS

Keuffel & Esser Co.—"Graph Sheets, Cross Sections & Profile Papers, Cloths, and Films," a newly revised 60-page catalog, consists of two sections: an introductory guide to the selection of grid patterns best suited to individual requirements, and pages selected from the complete K&E Catalog. The reprint pages also describe the various material available: drawing paper, tracing paper, Albanene, tracing cloth, and Herculene and Stabilene films. Applications, specifications and limitations of these various materials are also given.

209 THEODOLITES

Keuffel & Esser Co.—Three new theodolites, with seven major features engineered for American practice, are described in the 16-page catalog "Theodolites." Detailed are the KE-2, KE-1 and KE-6e; 1-sec, 20-sec and 1-min theodolites, respectively. Full details are given on the automatic indexing of veritcal circle, choice of erected or inverted image, leveling head joint system, control knobs located on one side, simultaneous viewing of both circles, optical plummet built into alidade and fully interchangeable accessories.

210 THREE-WHEEL ROLLER AND VIBRATORY COMPACTOR

The Galion Iron Works & Mfg. Co.—A combination 3-wheel roller and vibratory compactor is described in this bulletin. The compactor delivers 4200 deep-penetrating compacting vibrations per minute, leaving the surface smooth and flat without waves or "washboard" effect. The compactor is easily raised by hydraulic power controlled from the operator's platform, to allow the roller to do all of its regular rolling operations.

211 TIDE GATES

Brown & Brown, Inc.—Literature fully describes a complete line of metal tidal gates in 22 circular sizes and 47 rectangular sizes. Also described are timber gates to meet any requirements and a line of cushioned flap gates for use on pump discharge lines. Dimensional and loss of head data are given.

212 TOTEM-ALL

Birmingham Manufacturing Company, Inc.—There are two bulletins offered concerning this industrial tractor trailer. It is equipped to tilt to the ground at the rear for easy loading and unloading. Its main features are: the low deck, extra deck width and the deck mounted on springs. The capacity is 12,000 lbs. and it can carry tractors up to 8 feet in width.

213 TOWER CRANES

Mayco-Weitz Tubular Structures Corp. of America—These cranes can be quickly and economically converted into any other type. For example, a stationary crane can be converted into a traveling crane by the addition of power-driven bogies, or into a climbing crane by adding guide frames to the building floors. More information is available upon request.

214 TRACTOR-SCRAPERS

Caterpillar Tractor Company—The reasons why the exclusive torque divider transmission of the new Caterpillar 630 and 631 Tractor-Scrapers mean more yards per hour are explained in two new catalogs. These graphically show how the power shift transmission and the new 420 maximum horsepower diesel engine are perfectly matched to give greater performance, and increased profit.

215 TRANSIT

Keuffel & Esser Company—A color, six page brochure describes the new Paragon® Transit with six exclusive features including a fully achromatic, completely enclosed optical system. It provides true angle readings and is equipped with a two speed tangent screw permitting both rough and fine adjustment from one point.

216 TRANSITE PRESSURE PIPE

Johns-Manville—An 8-page brochure describes and enumerates the advantages of Transite Pressure Pipe for use in water mains. TR-160A contains tabular data giving the sizes and weights of the pressure pipes in the three available classes, 100, 150, and 200, including the weights of couplings for each. Considerable emphasis is given the Ring-Tite method of assembly.

217 TRANSIT MIXER

Blaw-Knox Company—Several new bulletins illustrate and describe the BuKaneer mixers, ranging in size from 4 to 10 cubic yards. It has a heavy duty transmission providing four forward and four reverse speeds in all three drives. The controls are easy to operate and it has several optional features including various sizes and styles of water tanks.

218 TRANSITS AND DUMPY LEVELS

Texas-Asiatic Import Co.—This literature describes the Eagle 6-in. Standard Transits (20-sec and 1-min horizontal verniers), which are made of solid bronze, with a unique 11-piece optical system and several refinements not found on any other instrument. It also describes the Eagle Engineer's Dumpy Levels, which are available in both an 18-in. and 15-in. model.

CATALOG DIGESTS

219 TRANSIT TRAVERSE COURSE

AGA Corporation of America—This report describes a 5-day test of a Model 4 Geodimeter, 15-minute quadrangle by the Map Testing Unit, Dept. of Interior. It provides tables and chronological description, and emphasizes the operational accuracy under torrential rainstorm conditions.

220 TREATMENTS FOR MASONRY

Standard Dry Wall Products, Inc.—Complete line of products for waterproofing, corrective and protective treatments for masonry are described in the 24-page Specification Guide. Method of application is thoroughly described in a series of photographs. Applications are listed with separate sections giving complete details on each product.

221 TRI-ACETATE SHEETS

Stanpat Company—Circular describing their printed adhesive-backed acetate sheets for speeding up drafting is available. These sheets are attached to original drawings and save draftsmen from redrawing standard details and repetitive notes. Resulting prints are clear and sharp and save tremendous amounts of time.

222 TRUE MERIDIAN IN DEFENSE PLANT

Kern Instruments Inc.—Civil Engineers reprint describes the use of a Kern Theodolite to solve the difficult problem of establishing a true meridian inside of a defense plant for testing of weapons components.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME

223 TUGGER HOIST

The Eimco Corporation—Features of the 210 Tugger Hoist, which is air powered for safe use under all dust or gaseous conditions, is described in Bulletin AE-6005. Details of the brake control, clutch lever, motor control and rope capacity are explained along with specification of the units.

224 TUNNEL EXCAVATOR

The Eimco Corporation—Case histories of tunnel mucking by 105 Excavator at Glen Canyon, Arizona; Fort Pitt, Pittsburgh and Mammoth Pool, California are featured in Bulletin L-1091. Specifications of the excavator in relation to tunnel work are contained in the 8-page bulletin.

225 TURBINE PUMP

The Deming Company—A multi-stage centrifugal pump with working parts down in the water is described in Bulletin 4700. The pumps deliver a large quantity of water from a given size well, and are very popular for deep well service. They have long life, are highly efficient and very little maintenance is required.

226 TURBINE PUMPS

Fairbanks, Morse & Co.—Water lubricated turbine pumps are covered in this new bulletin. The standard construction of the Pomona Turbine Pump is illustrated with descriptions of the various parts. Also, there are illustrations of the various types of heads and drives offered with the Pomona pump, and a selection of pumps for every pumping purpose.

227 UNDERDRAIN PIPE

Johns-Manville—This folder describes advantages of Johns-Manville perforated Transite® asbestos-cement underdrain pipe for airports, highways and other large areas where drainage is a problem. The pipe is designed for subgrade stabilization of soil by maximum control and removal of subsurface water. The physical and chemical qualities of asbestos and cement include: strength, toughness, light weight and resistance to internal corrosion and most chemical action.

228 UNDERGROUND IRRIGATION MAINS

Johns-Manville—Transite® underground irrigation mains for turf, landscaped areas and farm installations are described in booklets offered by Johns-Manville. Light weight, long lengths and Ring-Tite® joints result in economical assembly. Smooth pipe interior insures high water carrying capacity, reduces pumping costs, saves water. The pipe is non-metallic: can't rust and resists corrosion inside and out.

229 UNDERPINNING

Spencer, White & Prentis, Inc.—"Underpinning," a book by Edmund Astley Prentis and Lazarus White is recognized as the authoritative source for information in the field by engineers, architects and contractors all over the world. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

230 VAPOR SEAL

W. R. Meadows, Inc.—This booklet fully explains in a direct and easy to understand manner, the cause and effect of destructive moisture, the need for a true vapor seal and how "Premoulded Membrane" meets this need. The booklet covers architectural and engineering data, technical information, various applications and specifications.

231 VIBRATION AND SHOCK ISOLATORS

Voss Engineering, Inc.—Comprehensive technical manual will assist engineers in solving vibration and shock problems with Sorbtex preformed fabric neoprene and rubber pad materials. New concepts in the use of Sorbtex are presented for the first time.

232 WATERSTOP MANUAL

W. R. Meadows, Inc.—The availability of a manual on "Sealtight" PVC Waterstops has been announced. It describes applications, installation information, product specifications and engineering data, and gives complete range of product sizes and types.

Please note our deadlines. Requests cannot be processed after these dates.

233 WATER WELL SYSTEMS

Layne & Bowler—A four-page, color brochure giving general facts and information on water well systems, water pumps, well drilling and allied water services and equipment for municipalities, industry and agriculture is offered in bulletin No. 10. Additional bulletins are listed for detailed information on well drilling, well casing and screen, pumps, chemical treatment of water wells and water treatment.

234 WATTS AUTOSET LEVEL

Eugene Dietzgen Co.—A 5-page two-color folder that completely describes and illustrates the new automatic level called the Watts Autoset Level is available. Four diagrams describe the difference in operation between a conventional level and the new Autoset Level.

235 WELDED STEEL PIPE

Armco Drainage & Metal Products, Inc.—This comprehensive catalog, P. O. 8558, covers applications, advantages, specifications, production limits, tolerances, linings and coatings, fittings, joints, and other essential data for industrial uses. Some of the subjects are factory piping, process piping, water supply and waste disposal lines. Many tables of useful data are included for the designer.

236 WELDERS

Miller Electric Mfg. Co.—This booklet being offered gives a complete description of welders for all purposes. It includes: metallic welders, arc welders, light gauge metal welding, tungsten inert gas welding, movable coil welder, spot welders and a combination welder/power plant. Full information concerning size, weight, and ac/dc currents is also given.

237 WELLPOINT DEWATERING

Griffin Wellpoint Corporation—"The Griffin Wellpoint System," a 32-page digest showing a wide variety of wet jobs, many of which present unusual dewatering problems.

238 WELLPOINTS

Moretrench Corporation—A 4-page bulletin illustrating and describing standard and special types of Moretrench Wellpoints and their use in various types of jobs has been made available.

239 WELLPOINT SYSTEM

Moretrench Corp.—Pictured in this new 64-page catalog are various types of dewatered projects. The catalog gives factual descriptions of pumping problems successfully handled by this company's wellpoint equipment. There is also a list of brochures available for detailed information on key parts of pumping equipment.

CATALOG DIGESTS

240 WHITE CONCRETE

Universal Atlas Cement Co.—A 32-page brochure illustrating how architects and engineers are utilizing white cement in architectural concrete. It includes information on exposed aggregate, texture, pattern, shape, size, insulation and erection details of precast concrete panels facings and cast stone units.

241 WHITEPRINT MATERIALS

Ozalid, Div. of General Aniline & Film Corp.—Semi-dry diazo sensitized materials are described in this catalog and price list. Included are developing opaque and translucent papers.

242 WHITEPRINT MATERIALS

Ozalid, Div. of General Aniline & Film Corp.—This bulletin describes dry diazo-sensitized whiteprint materials: opaque papers, translucent papers, cloths, acetate films, polyester films.

243 WIRE ROPE

American Steel & Wire—This is a complete basic catalog for selecting wire rope for any use. Containing 88-pages, it gives the latest information and detailed displays necessary to the selection, recommendation and use of Tiger Brand Wire Rope and Fittings.

244 YIELDABLE ARCHES

Commercial Shearing & Stamping Company—A 12-page catalog 300-C3 on yieldable arches is now available. It describes the principle of the arches for underground support and how they work. Listed are complete technical information on segment and connection details, typical arch shapes, accessory details and dimensions. In addition, it describes roof bolt mats and support lagging in underground construction.

Return the coupon today!

245 ASBESTOS-CEMENT PRESSURE PIPE

Keasbey & Mattison Company—"The Heart of A Good Water System" is the title of a four-page folder describing products features and physical details of asbestos-cement pressure pipe for water systems. The folder (Ap-27) highlights the installation and maintenance economics and briefly explains the advantages of a patented coupling which provides permanent leak-tight and root-tight seals.

246 AERIAL COVERAGE INDEX

Fairchild Aerial Surveys, Inc.—is offering a new piece of literature which is best described as a coverage index to Fairchild's aerial photography and aeromagnetic service in the Western United States and throughout the world.

247 DIAMOND MASONRY BITS

Sprague & Henwood, Inc.—All three types of this company's Diamond Masonry Bits, resettable, throw-away and impregnated, are described in a new 4-page bulletin. In addition, the bulletin describes the various items of accessory equipment used in this type of drilling. These Diamond Masonry Bits ensure fast, low-cost drilling through reinforced concrete, brick, ceramics, asphaltic concrete, stone and plastics.

248 DRYER

The Simplicity System Company—A leaflet, now available describes the Simplicity Dryer, the core of any asphalt plant. It has aggregates cross-showered, more drying in less space, heat loss reduced by 318°, instant starting without "warming up", instant stopping without "cooling down", and efficient heating and drying—not just surface heating.

249 SOIL SAMPLING EQUIPMENT

Sprague & Henwood, Inc.—The new bulletin 300-1 covers a complete line of soil sampling equipment and the Models PD and PHD Soil Sampling machines. Recent engineering advances include the "wide open" flap valve and the vane shear tester.

250 CLARIFIER

Chain Belt Company—Featured in Bulletin No. 315-91 is the Rex Verti-Flo Clarifier. Some advantages include: utilizing full tank volume by elimination of short circuiting, complete adaptability for varying rates of flow with efficient operation at high overflow rates, sludge recirculation, complete hydraulic balance and can be installed in existing basins with a minimum of structural alterations to provide greater capacity.

251 CONCRETE AND MASONRY COMPOUNDS

Sika Chemical Corporation—A new 12 page catalog describes products available in the following categories—concrete admixtures; joint sealants, coatings and impregnations; surface retardants, quicksets and metallics; and epoxy compounds. Catalog lists uses and coverage for more than 30 chemical compounds for quality concrete construction. Bulletin SC-61.

There are 260 Digest items on pages numbered 118 to 143. Read all items for the literature of interest to you.

252 GRAY MASTIC JOINT AND CRACK SEALER

Sika Chemical Corporation—This bulletin describes a gray, non-meltable, non-skinning, mastic compound for effectively sealing joints and cracks subject to movement between construction material such as concrete, brick, masonry and metal. Gray Igas will dry out or become brittle. Bulletin GI-1160.

253 GROUTING AID

Sika Chemical Corporation—Intraplast C, a retarding and expanding grouting aid, increases fluidity and produces a slow, controlled expansion prior to hardening when added to cement grout. Common applications include grouting of prestressed tendons, machinery bases and pre-placed aggregates. It does not contain calcium chloride, nitrates, or other chemicals potentially contributing to stress corrosion in prestressed steel. Bulletin INPL-960.

CATALOG DIGESTS

254 LUBROVANS AND LUBMOBILES

Lincoln Engineering Company—Illustrations and specifications are given in this Engineering Manual No. 33 now available. These custom planned portable lubrication rigs are designed to meet every contractors' requirements.

255 PUMP STATIONS

Tex-Vit Supply Company—Descriptions, specifications and illustrations are given in this brochure now available. The advanced design of the duplex pump station utilizes Flexible Coupling between pump and motor which assures maximum strength and dependability. Motor and pump have individual shafts, and each carries its own thrust load. The heavy steel shell is water tight and especially coated with epoxy material thus preventing oxidation and other chemical corrosion.

256 SEWAGE TREATMENT

Link-Belt Company—The Bio-Pac, a single-unit sewage treatment, is described in this brochure. It represents a functional scaling down of large-capacity plant concepts to effectively handle the sewage needs for installations serving 50 to 500 people. It starts with the removal of settleable solids in a primary settling compartment, then is pumped to two bio-filters, where aerobic bacteria remove most of the suspended solids and the last stage is a final settling compartment, which completes the process of producing a stable effluent.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

257 EXPANSION PLATES & BUSHINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 55 contains complete information, technical data, and specifications about Lubrite self-lubricating expansion plates and bushings for bridges, buildings, refinery equipment, chemical processing equipment high temperature, missile and atomic applications. Lubrite plates or bushings are completely self-lubricating and do not require periodic maintenance or servicing. Ideal where ordinary lubrication is objectionable, neglected, expensive to maintain or for inaccessible plates or bushings.

258 SELF-LUBRICATING BEARINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 56 is a 24 page book filled with complete information, technical data, and specifications about Lubrite self-lubricating bushings, bearings, and washers for industrial equipment, machinery. Hydro-electric, high temperature, missile and atomic applications. Lubrite bearings are completely self-lubricating and do not require periodic maintenance or servicing. Ideal where ordinary lubrication is objectionable, neglected, expensive to maintain or for inaccessible bearings.

259 PIPE INSPECTION

National Power Rodding Corp.—A 30-page brochure describes closed circuit T.V. for inspection and trouble spotting areas in liquid transmission pipes of 4" to 144" for municipal and industrial use.

260 ASPHALT MIXTURE

Slurry Seal Inc.—Slurry Seal is an asphalt slurry mixture made from a closely graded fine aggregate, emulsified asphalt and water, all carefully calibrated and mixed to form a mortar-like compound. It is designed for easy spreading as a seal coat on streets, highways, airport runways, parking lots, driveways and other traveled surfaces. Illustrations and further descriptions are given in this 8-page booklet.

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PROCEEDINGS AVAILABLE

March

Journals: Air Transport, Construction, Irrigation and Drainage, Highways, Hydraulics, Sanitary Engineering, Structural.

2756. Needs in Sedimentation, by H. A. Einstein. (HY) An analysis of the design problems of alluvial river channels is studied, with concentration on sedimentation needs.

2757. Leaching Requirements in Irrigation, by Raymond A. Hill. (IR) A study of leaching in irrigation practice is presented, with emphasis on principal purposes.

2758. Airplane Performance and the Small Airport, by Walter E. Gillfillan. (AT) The importance of airplane performance data for the designer of small airport runways and runway approaches is illustrated.

2759. Aggregates and Fly-Ash Concrete for Barkley Lock, by Louis Campbell, Jr. (CO) Presents an actual account of the field handling of aggregates, mix data, and test results of fly-ash concrete.

2760. Cost Allocation of Water Projects in California, by Amalio Gomez. (HY) This paper describes the separable costs-remaining benefits method of allocating the costs of multiple-purpose water projects.

2761. Intercepting Drainage Wells in Artesian Aquifer, by Dean F. Paterson. (IR) A formula for channel seepage to a leaky artesian aquifer and the resulting piezometric surface is presented.

2762. Water Balance Recorder, by Hans Aslyng and Knud J. Kristensen. (IR) This paper presents a detailed description of the design and construction of a semi-floating lysimeter.

2763. Vector Aspects of Dynamic Similarity, by R. C. Kolf and W. L. Reitmeyer. (HY) A study of the laws of dynamic similarity emphasizing the refinements imposed by the vector nature of the fluid flow variables is presented.

2764. Safety, Reliability and Structural Design, by A. M. Freudenthal. (ST) The safety analysis of structural designs emphasizing the relationship and importance of the statistical distribution function (safety factor) and the "reliability function" is studied.

2765. Theory of Wave Agitation in a Harbor, by Bernard Le Mehaute. (HY) A first order theory for the value of the wave agitation in a simple basin caused by an incident periodical gravity wave is examined. Results obtained by theory are compared with those obtained experimentally.

2766. Prefabricated Reducers as Entrances for Pipe Culverts, by Harvey G. Aronson. (HW) An analysis is made of the improved flow rate made possible when prefabricated reducers are used as entrances for pipe culverts.

2767. Radiological Curricula for Sanitary Engineers, by John E. Kiker, Jr., and F. Wellington Gilcreas. (SA) The need for specialized programs for sanitary engineers concerning the control of environmental pollution from radioactivity is stressed.

2768. Marine Foundation Construction in Oil Fields, by S. J. Mathis. (CO) The method of constructing foundations of marine oil reservoirs is presented.

2769. Relation in Intake Rate to Length of Run, by A. Alvin Bishop. (IR) The relationship between the intake rate of the soil and the length of run in surface irrigation with regard to the amount of water lost below the root zone through the deep percolation is presented.

2770. Estuarial Sediment Transport Patterns, H. A. Einstein and R. B. Krone. (HY) The process of mud transportation emphasizing the flocculation characteris-

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(WW) Waterways and Harbors

PROCEEDINGS AVAILABLE

tics of suspended clays is studied.

2771. Pollution of the Androscoggin River, by E. Sherman Chase. (SA) The observations and analyses of the pollution problems of the Androscoggin River and the required remedial measures, since 1940, are presented.

2772. Vibration Problems in Hydraulic Structures, by Frank B. Campbell. (HY) A study of the vibration of control gates and regulating valves commonly used in hydraulic structures is presented.

2773. Blending Natural Earth Deposits—For Least Costs, by J. B. Ritter and L. R. Shaffer. (CO) The results of the process of blending natural earth deposits economically are studied.

2774. Runway Roughness Studies in the Aeronautical Field, by John C. Houbolt. (AT) Several phases of the runway roughness problem affecting airline operations are presented.

2775. Variable Head Technique for Seepage Meters, by Herman Bouwer. (IR) A technique for measuring canal or reservoir seepage losses with seepage meters is proposed.

2776. Stream-Gaging Network in the United States, by John E. McCall. (HY) The national stream-gaging program is analyzed with regard to size, cost, and comparison between the states and other countries.

2777. Stilling Basin Damage at Chief Joseph Dam, by R. H. Gedney. (HY) Reports on the causes of damage that have occurred to the stilling basin during construction, from 1952 to 1960, are examined.

2778. Removal of Floatables from Digested Sludge, by R. J. Theroux, C. H. Lawrance, and N. B. Hume. (SA) Descriptions of certain laboratory and pilot studies for effective and economical means of insuring removal of floatable fractions before discharge are analyzed.

2779. Matrix Analysis of Structures Curved in Space, by Frank Baron. (ST) A general solution is given in matrix form for the analysis of a member, curved or segmental in space and continuous between two supports.

2780. Forecasting River Runoff by Coastal Flow Index, by David M. Rockwood and Carlton E. Jencks. (HY) An index method for forecasting April-through-September runoff for the Columbia River at The Dalles, Oreg., is presented.

2781. Discussion of Proceedings Paper 2265, 2336, 2340, 2456, 2484, 2577. (HY) Joe L. Mogg on 2265. Herbert D. Vogel on 2336. T. Blench on 2340. Donald Van Sickle on 2456. Marcel Bitoun, Monir M. Kansoh on 2484. Jaime Amorocho, Merwin D. Dougal, Robert L. McFall and Ben A. Jones, Jr. on 2577.

2782. Discussion of Proceedings Paper 2513, 2592, 2604. (HW) Frank W. Herring on 2513. E. J. Woodward, Jr., Robert P. Lottman, F. N. Hveem, John L. McRae on 2592. Karl Moskowitz and Ichiro Fukutome on 2604.

2783. Discussion of Proceedings Paper 2424, 2556, 2558, 2607. (SA) A. M. Rawn, F. R. Bowerman, and Norman H. Brooks on 2424. Harold B. Gotaas on 2558. I. C. Hart and A. L. Downing on 2556. Jerzy Ganczarczyk on 2607.

2784. Nuclear Power for the Arctic, by William F. Reilly and John T. Rhett, Jr. (CO) A brief history of the Army's nuclear power and Arctic research and development programs, coupled with the installation of the PM-2A nuclear power plant on Camp Century, Greenland, is presented.

2785. Discussion of Proceedings Paper 2142, 2661. (CO) Roger H. Williams on 2142. Richard J. Newson on 2661.

2786. Discussion of Proceedings Paper 2160, 2595. (IR) William L. Berry and Edward D. Stetson on 2160. Gregory Efstratiadis on 2595.

2787. Discussion of Proceedings Paper 2314, 2346, 2542, 2545, 2608, 2633, 2643, 2680. (ST) Jan J. Tuma on 2314. Sabri Sami on 2346. T. Janiszewski and Blair Birdsall on 2542. John A. Blume on 2545. A. A. Eremin on 2608. Walter E. Kunze on 2633. Roy W. Clough on 2643. Merit P. White on 2680.

2788. Discussion of Proceedings Paper 2460. (AT) Gordon K. Ray and William G. Westall on 2460.

2789. Earthwork Computations on Electronic Computers, by Robert J. Hansen, S. Ray Cason, and Paul Yeager. (HW) This paper describes the complete system of earthwork computations presently being used. Included is a description of the basic earthwork quantity computations, the machine-computed template notes (including median design), and the by-products that provide additional services to the engineer.

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Owner: Federal Aviation Agency; **Consulting Engineer:** Ammann & Whitney, New York, N.Y.; **General Contractor** runways and turnoffs: C. J. Langenfelder & Sons, Inc., Baltimore, Md.

Concrete at new Dulles International Airport, Chantilly, Virginia, was centrally mixed and carried to the site in dumpcrete trucks.

High Speed paving with PLASTIMENT

Concreting the two-mile runways at the huge new Dulles International Airport near Washington, D. C., presented two major problems to the paving contractor: (1) limited workability at specified water cement ratio, and (2) rapid surface drying at high summer temperatures. Anticipating these problems, the consultants specified a retarding densifier to be used in variable proportions.

Plastiment Retarding Densifier produced the needed workability at 1-1/2" slump. Rapid, clear-water bleeding eliminated premature drying and provided sufficient moisture at the surface of the slab for proper finishing.

Compressive strength developed rapidly, averaging 2300 psi at 24 hours and 4200 psi in 3 days.

Plastiment features are fully detailed in Bulletin PCD-59. Ask for your copy. Offices and dealers in principal cities; affiliate manufacturing companies around the world. In Canada, Sika Chemical of Canada, Ltd.; in Latin America, Sika Panama, S. A.

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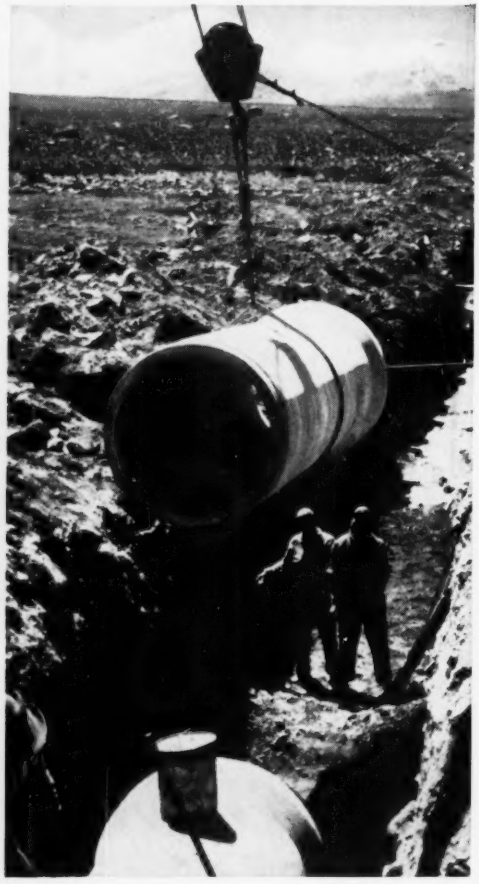

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LOCK JOINT PIPE COMPANY products for a variety of purposes are offered on a world-wide market. The majestic New York skyline looks down on a bargeload of 144" Lock Joint Concrete Subaqueous Pipe en route to a metropolitan sewer outfall project, as well as on Lock Joint Concrete Pile Sleeves being installed for the Port Authority's pier construction program.

15,000 feet up on the bleak slopes of the Andes, the installation of 40 miles of Lock Joint Concrete Pressure Pipe made vital water available to the Southern Peru Copper Company's $300,000,000 mining enterprise.

So it is throughout the world. Lock Joint products are bringing fertility to the Negev Desert. Additional water flows to thriving Cape Town through a Lock Joint supply line. Lock Joint transmission and distribution mains as well as sewer lines help meet greatly increased demands in booming Caracas. These are only a few of the thousands of communities at home and abroad served with complete satisfaction by Lock Joint Pipe Company.

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